Washoe County School District

Project Title:
Mini-Modernization
at Libby Booth Elementary School

Bid #:
27-17-B-09-BC

Date:
September 25, 2026

Prepared By:
Purchasing Department
14101 Old Virginia Road, Room 0
Reno, NV 89521
Phone: (775) 850-8025
Fax: (775) 857-3175
E-Mail: solicitations@washoeschools.net

SECTION 00090 - NOTICE TO CONTRACTORS

Sealed bids for the **Mini-Modernization at Libby Booth Elementary School** will be received by the Washoe County School District's (WCSD) Purchasing Department located at the Brown Center 14101 Old Virginia Road, Room #0, Reno, NV 89521, **until 2:00 p.m., (Local Time) on November 17, 2026**. The bids will be opened publicly via a TEAMS Meeting at **2:30 pm (local time).**

https://teams.microsoft.com/meet/21378861557538?p=A4c285SllWU3h6Zfs1
Meeting ID: 213 788 615 575 38
Passcode: wS3EB7Ci

Scope of Work: Tenant Improvement Scope: Alteration of interior spaces to provide two (2) updated classrooms, one (1) updated lounge, new drinking fountains in the Multipurpose Room, eight (8) updated administration rooms, one (1) updated restroom, and the repainting of the exterior of the main school building.

New STEAM + Media Center Building and Site Improvements Scope: Construction of new STEAM + Media Center building (approx. 5,000 SF), installation new play structures, construction of new masonry site wall, installation of new shade structure, installation of new fencing and pavement, and associated demolition and/or relocation of existing site features and structures. In addition, the Awarded Contractor shall include a minimum of five (5) hours per month of STEAM Requirements refer to STEAM Program (Science, Technology, Engineering, Art, Math) – Exhibit A

Additive Alternate #1: Repaint the exterior of the two (2) portables.

Contractor's Licensing
It is WCSD's opinion that the scope of work for this project qualifies for the following license groups: General Contracting AB, B and B2 licenses if, more than two (2) building trades are utilized; per NRS 338.139.

If a Contractor would like to seek clarification from the Nevada State Contractor's Board, then they must do so ten (10) days prior to the bid due date. https://www.nvcontractorsboard.com/

Contractors desiring to bid on this work shall be contractors presently licensed by the Nevada State Contractors Board and shall maintain a valid Contractor's License for the duration of the construction project. In addition, any and all Subcontractors that will be utilized by the Contractor shall also be presently licensed by the Nevada State Contractors Board and shall maintain a valid license for the duration of the construction project. All licensing requirements as specified in Nevada Revised Statutes (NRS) Chapter 624 shall also be strictly adhered to. Contractors shall also carry and provide evidence of required insurance liability coverage as specified in the Liability Insurance Specifications, as identified in Section 00800 – SUPPLEMENTARY GENERAL CONDITIONS.

NOTE: ***The Procurement Professional for this solicitation is named below. Interested parties may NOT contact anyone else regarding this solicitation. Any interested Bidder contacting any other individual including, but not limited to, WCSD staff, officials, evaluation committee members, or Board of Trustees may have their Bid submission rejected from evaluation and award consideration.***

Plans and specifications are available to view and download at WCSD's Purchasing Department website at http://solicitations.washoeschools.net/.

There will be a MANDATORY Pre-Bid Meeting held at 3:30 p.m. on October 13, 2026, at Libby Booth Elementary School (Meet in Front of the Office) 1450 Stewart St, Reno, NV 89502. Due to access and coordination involved in this project we highly recommend that contractors walk the project site that we are making available.

The physical work is to be commenced upon issuance of a "Notice to Proceed".
Work shall be completed on or before **October 28, 2027**.

Bid #27-17-B-09-BC
PWP # WA-2027-035

Procurement Professional: Bill Conn
Email: solicitations@washoeschools.net

To be published in the Reno Gazette Journal on September 25, 2026.

Washoe County School District
Purchasing Department
14101 Old Virginia Road, Room #0
Reno, NV 89521

Phone: 775-850-8025
Fax: 775-857-3175

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SECTION 00100 - INSTRUCTION TO BIDDERS

Bids must be submitted in accordance with the following instructions to be considered for review and award.

Bids shall be submitted on the provided Bid Form (PUR-F523) only, and all of the blank spaces shall be completed; numbers shall be stated both in writing and in figures, the signature shall be in longhand; and the completed form shall be without interlineation, alteration or erasure. **Any bid submission will be disqualified and rejected if the bid submission is not signed.**

Washoe County School District only accepts signatures done manually (also known as a wet signature) or electronic digital signatures that are certified. Non-certified electronic digital signatures will NOT be accepted. A typed signature, even in cursive font, DOES NOT meet the requirements of an official digital signature. A digital signature must be accompanied by a certified digital stamp issued through programs like Adobe Acrobat, Docu-Sign or other similar programs that produce a digital stamp certifying the electronic digital signature. Any signatures on required forms that do not meet these requirements will not be accepted and the Contractor's submission will be deemed "Non-Responsive" and will be rejected. If you have any questions about this requirement, please submit your question by the question deadline, so that it can be answered prior to the bid submission deadline.

In the event of a discrepancy on the Bid Form, NRS 104.3114 Contradictory terms of instrument states that, "If an instrument contains contradictory terms, typewritten terms prevail over printed terms, handwritten terms prevail over both, and words prevail over numbers." No additional pages containing inclusions, exclusions or clarifications will be accepted as part of the bid. Any clarifications, additions or exclusions made by the Washoe County School District (WCSD – OWNER) will be considered incorporated into the specifications.

The Contractor is responsible for ensuring he/she has received and reviewed the entire bid package, including all specifications, plans and any/all issued Addendums.

Bids shall be addressed to the WCSD and delivered to the office of the Purchasing Department, located at the Brown Center, 14101 Old Virginia Road, Room #0, Reno, Nevada 89521**, until 2:00 p.m., (Local Time) on November 17, 2026**. Bids shall be delivered sealed in an opaque envelope. The outside of the envelope shall be clearly marked to indicate the bid for the proposed work and directed to the Purchasing Department. The bids will be opened publicly via a TEAMS Meeting at 2:30 pm.

Each individual bid shall be accompanied by a surety company issued Bid Bond or by a Certified or Cashier's Check made payable to the *Washoe County School District*, in the amount of not less than five percent (5%) of the bid, said amount to be forfeited to WCSD, should the Contractor to whom the Contract is awarded fail to enter into the Contract in accordance with the Contractor's bid and any other contract documents and furnish the required bonds within ten (10) days after the delivery of notice of such award. Bid Bonds, upon request, or deposits of the unsuccessful bidders will be returned upon signing of Contract, or within forty-five (45) days from bid date, whichever is earlier.

Contractors desiring to bid on this work shall be Contractors presently licensed by the Nevada State Contractors Board and shall maintain a valid Contractor's license for the duration of the construction project. In addition, any and all Subcontractors that will be utilized by the Contractor shall also be presently licensed by the Nevada State Contractors Board and shall maintain a valid license for the duration of the construction project. All licensing requirements as specified in NRS Chapter 624 shall also be strictly adhered to.

WCSD requires that all Contractors who work on construction projects have in place a Drug and Alcohol Policy and this shall be acknowledged by signature on the Bid Form (PUR-F523).

The physical work is to be commenced upon issuance of a "Notice to Proceed".
Work shall be completed on or before **October 28, 2027**.

Contractor must agree that Owner may retain from the monies due the Contractor Two Thousand Five Hundred Dollars ($2,500) per day (Liquidated Damages) as a direct result of the Contractor's delay or for not completing the project in the required time allowance plus approved time extensions.

The right is reserved by WCSD to reject any and all bids or accept the bid, which is deemed by WCSD to be in the best interest of the school district. WCSD also reserves the right to waive any irregularities and/or informalities in the submitted bids.

Should a Contractor find discrepancies in, or omissions from, the drawings or documents, or should he/she be in doubt as to the meanings of said documents, he/she should immediately notify the Owner in writing via Email to solicitations@washoeschools.net, whereas the Owner will send written instruction via Addendum to all Contractors. The Owner, Architect/Engineer, Project Manager, Assistant Project Manager, or any other WCSD staff member will not be held responsible for any oral instructions provided during the bid submission process.

Before submitting a bid, Contractors shall carefully examine the scope of work outlined in the bid package and the proposed drawings, specifications, and forms and shall be thoroughly familiar with all existing conditions and expectations of a successful project completion.

No increase in cost or extension in performance time will be considered for failure to know the conditions to be encountered as to the character, quality, and quantity of the work to be performed, and materials to be furnished, and as to the requirements of the specifications.

No increase in cost or extension in performance time will be considered for material escalation. Section 01027 – Applications for Payment, Part 1, Subpart 1.3, Schedule of Values; B,5 of the contract documents provides a provision for the storage of materials, off-site if necessary, to help in managing the project costs and to hedge against potential future material price increases.

A 5% list showing all Subcontractors to be used on the project shall be submitted with the bid followed by a 1% list within 2 hours from the completion of the bid opening, as required

by Nevada Revised Statutes. WCSD also requires a Comprehensive Contractor/Subcontractor list showing all remaining subcontractors to be utilized on the project. All subcontractors shall be licensed as required by Nevada Revised Statutes.

Any Addendums issued during the bid solicitation process shall be acknowledged on the Bid Form (PUR-F523) and in the execution of a contract, Addendums will become a part thereof.

All questions shall be submitted in writing directly to WCSD's Solicitations website at http://solicitations.washoeschools.net/ or via e-mail to solicitations@washoeschools.net

This project will have two (2) question deadlines:

- Initial questions shall be submitted by **4:30 p.m. (Local Time) on October 21, 2026,** and an addendum will be issued with responses.

- All FINAL questions shall be submitted by **4:30 p.m. (Local Time) on November 3, 2026,** and a FINAL addendum will be issued with responses.

During this active solicitation there shall be no personal contact with any WCSD employees or other parties associated with this project directly. All inquiries shall be done in writing as stated above.

Addendums will be distributed by WCSD accordingly and can also be accessed via the WCSD Public Works website at: **http://solicitations.washoeschools.net/**

Modifications to bids may only be considered if submitted bids by delivery as previously noted have already been received and said modifications are completed prior to the due date and time for the bid submission.

Bids may be withdrawn in a written request received from a Contractor prior to the time fixed for opening of bids.

In cases where the award of the project has not been made, bids submitted and opened may not be withdrawn for a period of forty-five (45) calendar days from the due date and time of the bid.

A person who bids on this work may file a notice of protest regarding the awarding of the contract with the WCSD's Purchasing Department's Director of Procurement and Contracts within five (5) business days after the date the recommendation to award a contract is issued. The notice of protest must be submitted in accordance with NRS Chapter 338.142. Detailed specifications can be found in Section 00820 – Special Conditions, subsection 14.0 – Appeal by Unsuccessful Bidder.

A person filing a notice of protest in accordance with NRS Chapter 338.142 will be required to post a bond or other security in the amount of twenty-five (25%) percent of the value of the total bid or two hundred fifty thousand ($250,000) dollars, whichever is less. If the protest cannot be resolved by the WCSD's Director of Procurement and Contracts, it will be presented to the WCSD Board of Trustees at a regular meeting.

Contractors to be considered as a Preferential Bidder must submit the Certificate of Eligibility for Preferential Status issued by State of Nevada Contractors Board with their bid submission and the Preferential Bidder Status Affidavit must be provided within two (2) hours after the bid opening, although WCSD prefers the affidavit to also be submitted with the bid at the time of opening.

SPECIAL NOTIFICATIONS

Signature Requirements

Any bid submission will be disqualified and rejected if the bid submission is not signed.

Washoe County School District only accepts signatures done manually (also known as a wet signature) or electronic digital signatures that are certified. Non-certified electronic digital signatures will NOT be accepted. A typed signature, even in cursive font, DOES NOT meet the requirements of an official digital signature. A digital signature must be accompanied by a certified digital stamp issued through programs like Adobe Acrobat, Docu-Sign or other similar programs that produce a digital stamp certifying the electronic digital signature. Any signatures on required forms that do not meet these requirements will not be accepted and the Contractor's submission will be deemed "Non-Responsive" and will be rejected. If you have any questions about this requirement, please submit your question by the question deadline, so that it can be answered prior to the bid submission deadline.

Preferential Bidders

Contractors to be considered as a Preferential Bidder must submit the Certificate of Eligibility for Preferential Status issued by State of Nevada Contractors Board with their bid submission and the Preferential Bidder Status Affidavit must be provided within two (2) hours after the bid opening, although WCSD prefers the affidavit to also be submitted with the bid at the time of opening. Preferential Bidder Status shall be considered if the amount of the apparent low bid is $250,000 or greater per NRS Chapter 338.1389.

Specifications/Addendums

Contractor is responsible to ensure that he/she has received and reviewed the entire bid package, including specifications, plans and any/all issued Addendums. Contractors shall acknowledge by signing any issued Addendum(s) and returning the signed Addendums with his/her bid submission.

Technical Specifications

Any conflicts between the Architect and WCSD specification, it will be the responsibility of the Contractor to seek clarification for any conflicts or be responsible for all the requirements. Clarifications and questions must be submitted in writing via email to: solicitations@washoeschools.net

Washoe County School District Structured Cabling Standard – WCSD-SCS-015

The Washoe County School District Structured Cabling Standard – WCSD-SCS-015 dated March 13, 2023 is located on our website. The link to view it is https://www.washoeschools.net/cms/lib/NV01912265/Centricity//Domain/70/ITPC%20Images/WCSD-SCS-015%203-10-23.pdf

Project Completion

The construction contract time allowed for this project is based on a reasonable expectation of how long it will take to do a project of this scope. WCSD recognizes that Contractors often try to finish projects in significantly less time than the construction contract time and, in such cases, develop schedules which are based on everything going smoothly with no delays. While WCSD allows Contractors to submit such accelerated

construction schedules, WCSD reserves the right to deny the Contractor's submission. Acceptance of a submittal with a shortened schedule is not an official agreement between WCSD and the Contractor that the project can be done in less time than the construction contract time specified.

Roof Penetrations

All roof-mounted equipment or penetrations associated with this project are to be flashed by a licensed roofing Contractor. The roofing Contractor shall have experience with the existing roofing membrane. New flashing materials shall be installed to comply with the membrane manufacturer's specifications or details published by the National Roofing Contractors Association Waterproofing Manual. In acceptance of the work, the Owner will make no allowance for lack of skill on the part of the Contractor. The Contractor shall coordinate all aspects of roof work including any penetrations to maintain the building in a totally watertight condition, no exceptions.

Hours

There is a potential that Summer School, Extended School Year (ESY), Intercession School, After School Care, Parent nights, etc. may be held at the project sites. The Contractor will be required to flex schedule and/or work areas to accommodate school needs during this time frame. In addition, the Contractor may have to alter their normal schedule in order to perform any lead and asbestos attachments and penetrations.

Pre-Bid Meeting Attendance

All Pre-Bid Meetings, whether mandatory or not, will require that all attendees sign in on the sign-in sheet provided. It is the Contractor's responsibility to ensure that he/she documents his/her attendance by signing the Pre-Bid Sign-In Sheet. Failure to do so could result in the Contractor's bid not being accepted by the WCSD, especially in the event of a Mandatory Pre-Bid Meeting.

Mandatory Pre-Bid Meetings require attendees, who intend to bid on the project and act as the Prime Contractor, to participate in the entire meeting including site walk. Attendance will be recorded at the beginning and at the conclusion of the site walk on the Pre-Bid Sign-In Sheet and then posted on the Solicitations website. Leaving prior to the conclusion of the site walk risks contractor's attendance being disqualified and struck from the sign-in sheet.

In addition, if a Pre-Bid Meeting is held on-site, especially a school site, it is the Contractor's responsibility to sign in/register presence on grounds with the site's Front Office. A signature on a school's office sign-in sheet will not take the place of signature on the Pre-Bid Sign-In Sheet, which will only be present at the actual meeting and distributed by the staff of the Purchasing Department and Capital Projects Department.

Questions

This project will have two (2) question deadlines:

- Initial questions shall be submitted by **4:30 p.m. (Local Time) on October 21, 2026,** and an addendum will be issued with responses.

- All FINAL questions shall be submitted by **4:30 p.m. (Local Time) on November 3, 2026,** and a FINAL addendum will be issued with responses.

All questions shall be submitted in writing directly to WCSD's Solicitations website at http://solicitations.washoeschools.net/ or via e-mail to solicitations@washoeschools.net.

Force Accounts

When applicable, the force account amount listed on the Bid Form (PUR-F523) shall be used for changes in the work at the Owner's discretion. Any changes shall be approved by change order and the force account balance shall be reduced to reflect said change. Any remaining force account balance at the completion of the project shall be returned to the Owner by a deductive change order.

Working Hours

Work on the STEAM and Media Center building can occur from 7:00 a.m. until 5:00 p.m. Monday through Friday. Work zone to be fully enclosed with fence and screening material. Deliveries to and from the new building to be limited when students are not in the area such as lunch or recess. Field irrigation and landscaping to be maintained throughout construction. New building and sitework/painting activities must be completed prior to October 28, 2027.

Tenant Improvement work in the existing building to occur during standard work hours, with abatement occurring when school is not in session while no students are present.

Standard Working hours:

When School is **Not in Session**: From 7:00 a.m. until 3:30 p.m. Monday through Friday the project site will be available to the Contractor.

When School is **In Session**: From 3:30 p.m. until 11:00 p.m. Monday through Friday the project site will be available to the Contractor.

New Office Suite activities to occur between March 22, 2027, through July 16, 2027. Bathroom Improvements and Staff Lounge activities to occur between June 7, 2027, through July 23, 2027.

Special Note

Deliveries and large trucking operations shall be scheduled and coordinated to avoid peak school traffic periods, specifically the twenty (20) minutes before the start of the school day and the twenty (20) minutes following school dismissal.

WCSD's Project Management Software (Procore)

The Awarded Contractor will be required to utilize WCSD's Project Management Software (Procore) for workflow of project documents. This will include, but not limited to submissions of RFIs, submittals, schedule and schedule updates, change documents, payment requests, and close out documents. The Awarded Contractor will be required to work with WCSD Project Manager and WCSD Consultants to manage process to meet project schedule needs. See Section 01041 – Project Management Software for details.

Manufactured Housing Division Licensing

Upon consultation and advice from the State of Nevada's Department of Business and Industry – Manufactured Housing Division (Division), in order to submit a bid for work on

a new or existing mobile the Prime Contractor submitting the bid, if required by the Division, and all of his/her Sub-Contractors physically working on the mobile must be properly licensed by the Division as a Serviceperson. Additionally, many of the Sub-Contractors involved in this work may also be required to obtain their own permit from the Division in addition to the required Serviceperson's License.

If you have any questions or need clarification on what the Manufactured Housing Division and/or NRS 489 requires for permitting and licensing of work performed on Mobile Buildings, please feel free to go to the Division's website at http://mhd.nv.gov/ or call them directly at 775-684-2945. The Nevada State Contractor's Board is also very familiar with what Contractors are required to have in order to perform work on Mobile Buildings and often distribute information in their newsletter, Horizons.

Construction Note

Construction Materials are unstable at times and Division 1 of the Spec Book has a provision to assist in managing project costs and to hedge against potential future material price increases. The provision can be found in Section 01027 – Applications for Payment; Part 1 – General; Subpart 1.3 Schedule of Values; B; 5.

Public Outreach

The Awarded Contractor shall provide, on a monthly basis for the duration of the project, a Monthly Project Status Report for distribution to the public which includes:

- Overall project status schedule
- 3 week look ahead schedule
- Photos of progress completed

In addition, the Awarded Contractor must be available and prepared to present information regarding the status of the project at a two (2) hour monthly public meeting. The dates of these meeting will be coordinated with WCSD and the Contractor.

SECTION 00400 – SAMPLE BID BOND (PUR-F525)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned _____, as Principal, and _____ as Surety, are hereby held and firmly bound unto the Board of Trustees, Washoe County School District, as Owner, in the sum of _____ _____Dollars ($_____) for payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

Signed this _____day of_____, 20____.

The condition of the above obligation is such that whereas the Principal has submitted to the Board of Trustees, Washoe County School District, a certain bid, attached hereto and hereby made a part hereof, to enter into a Contract in writing for: _____.

NOW, THEREFORE, if said bid shall be rejected, or in the alternative, if said bid shall be accepted and the Principal shall execute and deliver a Contract in the form of Contract attached hereto (properly completed in accordance with said bid) and shall furnish a Bond for its Faithful Performance of said Contract, and a Bond for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the contract created by the acceptance of said bid, then this obligation shall be void.

Otherwise, the same shall remain in force and effect, and the sum herein specified paid over to the Owner; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Owner may accept such bid; said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their officers, the day and year first set forth above.

_____

_____

Principal

(Seal)

By: _____

_____

Surety

By: _____

Address:

(Seal)

_____

_____

_____

Phone: _____

SECTION 00500 – SAMPLE CONTRACT (PUR-F532)

THIS CONTRACT, made by and between _____ hereinafter called the Contractor, and **WASHOE COUNTY SCHOOL DISTRICT**, hereinafter called the Owner,

WITNESSETH, that the Contractor and the Owner, for the consideration hereinafter named, agree as follows:

Article 1 – Scope of Work. The Contractor shall furnish all of the materials and perform all of the work in conformance with the Contract Documents entitled **_____(Bid #_____).**

Article 2 – Time of Completion. The work to be performed under this Contract shall be commenced on the date set forth in the Notice to Proceed and shall be completed on or before **_____ or in _____ calendar days**. The Contractor agrees that Owner may retain from the monies due the Contractor the actual value of the damages to the Owner as a direct result of the Contractor's delay or for not completing the project in the required time allowance plus approved time extensions.

Article 3 – The Contract Sum. The Owner shall pay the Contractor for the performance of the Contract, subject to additions and deductions provided therein, in current funds the following stipulated sum:
_____($_____).

Article 4 – Progress Payments. The Owner shall make payments and pay interest to the Contractor in accordance with Nevada Revised Statutes, Chapter 338. No monies payable under this Contract shall be assigned by Power of Attorney, or otherwise, except upon written consent of Owner.

Article 5 – Acceptance and Final Payment. Upon written notice to the Owner that the work is one hundred percent (100%) complete, the Owner shall inspect the project. When the project is one hundred percent (100%) acceptable and complete to the Owner, the Contractor shall submit evidence satisfactory to the Owner that all payrolls, material bills, interest on retention, and other indebtedness connected with the work have been paid. Once all requirements have been satisfied, the Owner shall issue a fully executed Certificate of Completion which shall constitute the Owner's acceptance of the work in accordance with NRS Chapter 338.

Article 6 – The Contract Documents. The entire bidding documents, including but not limited to the: Notice to Contractors, Instructions to Bidders, Contractor's Bid, General Conditions, Supplementary Conditions, Special Conditions, Technical Specifications, Addenda, and the Drawings (if any), and this document form the Contract, and they are as fully a part of the Contract as if hereto attached.

Article 7 – Lead and Asbestos Certification. The Contractor hereby certifies that no lead/asbestos containing building material will be used for the construction of the project. If a lead/asbestos containing building material is subsequently found to have been included in the construction of the project, the Contractor shall be responsible for and indemnify the Owner against all costs for the proper removal of the lead/asbestos containing building material and the replacement of said material with a non-lead/asbestos containing material substitute. The removal method shall be specifically approved by the Owner and any and all authorities having jurisdiction over such removal.

IN WITNESS WHEREOF, the parties hereto have executed this Contract the day and year written below.

Bid #_____ - _____

WASHOE COUNTY SCHOOL DISTRICT	CONTRACTOR
_____	_____
Signature	Signature
_____	_____
Name	Name
_____	_____
Title	Title
_____	_____
Date	Date

SECTION 00600 – SAMPLE LABOR AND MATERIALS BOND (PUR-F526)

KNOW ALL PERSONS BY THESE PRESENTS: That WHEREAS, the Board of Trustees of Washoe County School District in the State of Nevada has awarded to _____, hereinafter designated as "Principal", a contract dated _____, for _____ _____ _____ a copy of which contract is attached hereto and by reference made a part hereof, and hereinafter referred to as the "Contract."

And WHEREAS, said Principal is required under the terms of said Contract and by law under the provisions of NRS Chapter 339 to furnish a Bond for the Labor and Materials used in said Contract;

NOW, THEREFORE, we, the Principal, and _____, as Surety, are held and firmly bound unto the Board of Trustees of Washoe County School District in the State of Nevada in the sum of _____ Dollars ($_____), lawful money of the United States, being not less than one hundred percent (100%) of the estimated Contract cost of the work, for the payment of which sum will and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if the above-bounden Principal, or its heirs, executors, administrators, successors or assigns shall fail to pay for any materials, provisions, supplies implements or machinery used in, upon, for, or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, or for amounts due under the Unemployment Compensation Law with respect to such work or labor, as required by the Provisions of NRS Chapter 339, the Surety hereon will pay for the same within thirty (30) calendar days an amount not exceeding the sum specified in this bond, and the above obligation shall then be null and void. Otherwise, it shall remain in full force and virtue.

THE SURETY, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to the work to be performed thereunder, or to the specifications accompanying the same, shall in any way affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work, or to the specifications.

And the said Surety, for value received, further stipulates and agrees that should the Board of Trustees of Washoe County School District, or other obligees, incur attorney's fees or other expenses for the enforcement of the Contract or this bond, the same shall

be paid by the Surety to the contracting body, subcontractors, workmen laborers, mechanics and furnishers of material as their interests may appear.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their seals this_____ day of _____, 20_____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____

_____
Principal

(Seal) By: _____

_____
Surety

By: _____

Address:

(Seal)

_____

_____

_____

Phone: _____

SECTION 00610 – SAMPLE PERFORMANCE BOND (PUR-F527)

KNOW ALL PERSONS BY THESE PRESENTS: That WHEREAS, the Board of Trustees of Washoe County School District in the State of Nevada has awarded to_____, hereinafter designated as "Principal": a contract dated _____, for _____
_____
a copy of which contract is attached hereto and by reference made a part hereof, and hereinafter referred to as the "Contract".

And WHEREAS, said Principal is required under the terms of said Contract and by law under the provisions of NRS Chapter 339 to furnish a Bond for the faithful Performance of said Contract;

NOW, THEREFORE, we, the Principal, and _____, as Surety, are held and firmly bound unto the Board of Trustees of Washoe County School District in the State of Nevada in the sum of _____Dollars ($_____), lawful money of the United States, being no less than one hundred per cent (100%) of the estimated Contract Cost of the work, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if the above bounden Principal, or its heirs, executors, administrators, successors, or assigns, shall in all things stand to and abide by and well and truly keep the faithfully perform the covenants, conditions, and agreements in the Contract and any alterations made as therein provided, on his or its part to be kept and performed at the respects according to their true intent and meaning; and shall indemnify and save harmless the Board of Trustees of Washoe County School District in the State of Nevada, its officers and agents, as therein stipulated; then this obligation shall become null and void. Otherwise, it shall be and remain in full force and virtue.

As a condition precedent to the satisfactory completion of the Contract, the above obligation shall hold good for a period of one (1) year after completion and acceptance of the work done, during which time if the above-bounden Principal, his or its heirs, executors, administrators, successors, or assigns shall fail to make full, complete, and satisfactory repair and replacements or totally protect the Board of Trustees of Washoe County School District in the State of Nevada from loss or damage made evident during said period of one (1) year from the date of acceptance of said work, and resulting from or caused by defective materials or faulty workmanship in the prosecution of the

work done, the above obligation in the said sum of _____Dollars ($_____) shall remain in full force and virtue; otherwise, the above obligation shall be void.

THE SURETY, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to the work to be performed thereunder, or to the specifications accompanying the same, shall in anyway affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the work, or to the specifications.

And the said Surety, for value received, further stipulates and agrees that should the Board of Trustees, Washoe County School District, incur attorney's fees or other expenses for the enforcement of the Contract or his/her bond, the same shall be paid by the Surety to the Board of Trustees, Washoe County School District.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their seals this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____

_____
Principal

(Seal) By: _____

_____
Surety

By: _____

Address:

(Seal)

_____

_____

_____

Phone: _____

SECTION 00700 – GENERAL CONDITIONS

The General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition, Articles 1 through 15, are hereby incorporated by reference as the “General Conditions of this Project.” Copies of General Conditions may be examined or obtained through formal request to the WCSD’s Purchasing Department located at the Brown Center, 14101 Old Virginia Road, Room 0, Reno, Nevada, 89521 or by phone at (775) 850-8025.

The information contained in the Supplementary General Conditions (Section 00800), Special Conditions (Section 00820), Instructions to Bidders (Section 00100), and the Bid Form (PUR-F523) shall become a part of the Contract and shall apply to all Contractors and Subcontractors. The information contained in Supplementary General Conditions (Section 00800) may amend, modify, supersede, void or supplement the Articles of the “General Conditions of the Project.” Where any part of an Article of the “General Conditions of the Project” is amended, modified, superseded or voided by a provision of the Supplementary General Conditions (Section 00800) or other Contract documents, all other provisions of such Article shall remain in effect, and the provisions of the Supplementary General Conditions (Section 00800) or other Contract documents shall be considered as added.

SECTION 00800 – SUPPLEMENTARY GENERAL CONDITIONS

The General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition, Articles 1 through 15, are hereby incorporated by reference as the “General Conditions of this Project.” Copies of General Conditions may be examined or obtained through formal request to the WCSD’s Purchasing Department located at The Brown Center, 14101 Old Virginia Road, Room 0, Reno, Nevada, 89521 or by phone at (775) 850-8025.

The information contained in the Supplementary General Conditions (Section 00800), Special Conditions (Section 00820), Instructions to Bidders (Section 00100), and the Bid Form (PUR-F523) shall become a part of the Contract and shall apply to all Contractors and Subcontractors.

In any instance where no Architect is involved in the project, any and all references contained in this or any other documents to "Architect" shall be deemed to refer to the consulting Engineer, if any, the special project consultant, if any, or, in the event no such individuals are involved, to the Owner.

The following supplements modify, delete and/or add to the “General Conditions of the Project.” Where any Article, Paragraph or Subparagraph in the “General Conditions of the Project” is supplemented by one of the following Paragraphs, the provisions of such Article, Paragraph, or Subparagraph shall remain in effect and the supplemental provisions shall be considered as added. Where any Article, Paragraph, or Subparagraph in the “General Conditions of the Project” is amended, voided or superseded by any of the following paragraphs, the remaining provisions of such Article, Paragraph or Subparagraph not amended, voided, or superseded shall remain in effect.

1. LIABILITY INSURANCE SPECIFICATIONS

A. INTRODUCTION

The Owner has established specific indemnification and insurance requirements for its construction contracts to help assure that reasonable insurance coverage is purchased and maintained. Insurance, indemnification and hold harmless clauses are intended to assure that a Contractor accepts and is able to pay for the loss or liability related to its activities.

Contractor’s attention is directed to the insurance requirements below. It is recommended that Contractors confer with their respective insurance carriers or brokers to determine **in advance of Bid submission** the availability of insurance certificates and endorsements as described and provided herein.

B. INDEMNIFICATION AGREEMENT

The Contractor agrees to hold harmless, indemnify and defend the Owner, its officers, agents, employees and volunteers from any loss or liability, financial or otherwise resulting from any claim, demand, suit, action, or cause of action based on bodily injury, including death, or property damage, including damage to the

Contractor's property or injury to the Contractor's employees, caused by any action, either direct or passive, the omission, failure to act or negligence on the part of the Contractor, employees, agents, representatives or Subcontractors arising out of the performance of work under this Contract by the Contractor, or by others under the direction or supervision of the Contractor.

In determining the nature of the claim against the Owner, the incident underlying the claim shall determine the nature of the claim, notwithstanding the form of the allegations against the Owner.

In the event of a lawsuit against the Owner, its officers, agents, employees and volunteers, the Contractor shall reimburse the Owner for costs of the Owner's attorneys' fees and costs, as well as personnel in defending such actions. Reimbursement for the time spent by such personnel shall be at the rate charged for such services by private counsel. The Owner shall not be held liable for any accident, loss or damage to the work prior to its completion and acceptance.

C. GENERAL REQUIREMENTS

The Contractor shall purchase Workers Compensation Insurance, General Liability and Automobile Liability as described below. The cost of such insurance shall be included in the Contractor's bid price.

D. WORKERS COMPENSATION INSURANCE

It is understood and agreed that there shall be no Workers Compensation Insurance coverage provided for the Contractor or any Subcontractor by the Owner. Contractor agrees, as a precondition to the performance of any work under this Contract and a precondition to any obligation of the Owner to make any payment under this Contract, to provide Owner with certificates issued by an insurer that shows compliance with NRS Chapters 616A, 616B, 616C and 616D, inclusive, and Chapter 617.

It is further understood and agreed by and between the Owner and the Contractor that the Contractor shall procure, pay for, and maintain the above-mentioned Workers Compensation Insurance coverage at the Contractor's sole cost and expense.

Should Contractor be self-funded for Workers Compensation Insurance, Contractor shall notify Owner in writing prior to the acceptance of this Contract. Owner reserves the right to approve said retentions and may request additional documentation, financial or otherwise, for review prior to the acceptance of this Contract as provisioned under NRS Chapter 616B.627.

E. MINIMUM SCOPE OF LIABILITY INSURANCE

Coverage shall be at least as broad as:

1. Insurance Services Office (ISO) Commercial General Liability Coverage "Occurrence" form CG 0001 12 04 or substitute form

providing coverage as broad as CG 0001 12 04. The Commercial General Liability Coverage shall include, but is not limited to,
Liability Coverage arising from Operations, Premises, Blanket Contractual Liability, Broad Form Property Damage Liability, Products and Completed Operations, Personal Injury and Advertising Liability, and Stop Gap or Employers Liability. In addition, explosion, collapse, and underground coverage must be included unless Owner waives this requirement in writing prior to execution of Contract.

2. Business Auto Coverage form number ISO CA 0001, CA 00 055, CA00 12, CA 00 20 or an equivalent form covering Automobile Liability Symbol 1 "Any Auto."

F. MINIMUM LIMITS OF INSURANCE

The Contractor shall maintain limits no less than:

1. General Liability: **$2,000,000** minimum or the amount customarily carried by the Contractor, whichever is greater, combined single limit per occurrence (with $4,000,000 Aggregate Limit) for bodily injury, personal injury, and property damage. General Liability coverage shall specifically apply to the acts and/or omissions of Contractor and his/her Subcontractors. The above General Liability coverage shall be maintained in full force and effect for five (5) years from the date of completion of the project. The required limits may be met through a combination of primary and excess liability coverage. Any excess liability coverage shall provide coverage at least as broad as the primary coverage and be subject to all of the requirements herein.

2. Automobile Liability: $1,000,000 minimum or the amount customarily carried by the Contractor, whichever is greater, combined single limit per accident for bodily injury and property damage. No Aggregate Limits may apply. Non-owned and hired automobile liability must be included.

3. Workers Compensation Insurance: $1,000,000 minimum in limits (Employers Liability) and obtain Statutory Limits of Workers Compensation Insurance for employees engaged on or at the site of the project in accordance with NRS Chapters 616A, 616B, 616C and 616D, inclusive, and Chapter 617. If an excess policy is utilized, the policy will provide excess coverage for Employers' Liability.

4. Asbestos Environmental Risk Liability Insurance: $5,000,000 minimum, per occurrence (with $5,000,000 Aggregate Limit). Refer to Section 00820 – Technical Specifications for important information).

G. ASBESTOS COVERAGE

In the event that asbestos abatement is required on this project, Asbestos Liability Insurance is required. To that end, the Contractor will be required to provide written proof by way of an insurance certificate of a minimum of Five Million Dollars ($5,000,000) occurrence-based Asbestos Environmental Risk Liability Insurance from a domestic Insurance company that has an A, A+ or A++ rating in Best's Insurance Guide, OAE. The Asbestos Abatement Contractor shall name the WCSD additionally insured on a primary and non-contributory basis for the contract term as well as any asbestos consultants the District may hire for job design and/or supervision and shall provide an insurance certificate specifically naming them as additionally insured, primary and stating that the policy cannot be cancelled in less than 30 days for any reason including non-payment.

H. PROPERTY COVERAGES

Not Required for this Project.

I. DEDUCTIBLES AND SELF-INSURED RETENTIONS

Any deductibles or self-insured retention must be declared to and approved by the Owner. The Owner reserves the right to request additional documentation, financial or otherwise, prior to giving its approval of the deductibles and self-insured retention's and prior to executing the Contract. Any changes to the deductibles or self-insured retentions made during the term of this Contract or during the term of any policy, must be approved by the Owner prior to the change taking effect. It is also understood that the Contractor is responsible for and shall assume payment of all deductibles and/or self-insured retentions.

J. OTHER INSURANCE PROVISIONS

The policies are to contain, or be endorsed to contain, the following provisions:

1. General Liability and Automobile Liability Coverages

   a. The Owner, its agents, officers, employees and volunteers are to be included as Additional Insureds for damages and defense arising from: activities performed by or on behalf of the Contractor, including the insured's general supervision of the Contractor; products and completed operations of the Contractor; premises owned, occupied or used by the Contractor; or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the Owner, its officers, employees or volunteers.

   b. The Contractor's insurance coverage shall be primary insurance with respect to the Owner, its officers, employees and volunteers. Any insurance or self-insurance maintained by the Owner, its officers, employees or volunteers shall be in excess

of the Contractor's insurance and shall not contribute to the Contractor's insurance coverage in any way.

c. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

d. The insurance companies issuing the policy or policies shall have no recourse against the Owner payment of any premiums, costs or assessments under any form of policy.

e. Failure of the Contractor to take out and/or maintain any required insurance shall not relieve the Contractor from any liabilities under this Contract, nor shall the insurance requirements be construed to conflict with or otherwise limit the obligations of the Contractor concerning indemnification.

2. All Coverages

a. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled or non-renewed by either the Contractor or by the insurer, reduced in coverage or in limits except after thirty (30) days prior written notice has been given to the Owner, which must be approved, if acceptable, by the Owner in writing.

Furthermore, Contractor shall provide the Owner thirty (30) days prior notice, in writing when the Contractor elects to change carriers, not to renew the policy, or reduce coverage, which must be approved, if acceptable, by the Owner also in writing.

b. The Contractor's insurers shall have no right of recovery or subrogation against the Owner or the design professionals which provide work on the project.

c. Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the Owner, its officers, employees or volunteers.

d. The insurance companies issuing the policy or policies shall have no recourse against the Owner for payment of any premiums, costs or assessments under any form of policy.

K. ACCEPTABILITY OF INSURERS

Insurance is to be placed with insurers with an A.M. Best's rating of no less than A:X. The Owner may accept coverage with carriers that have lower A.M. Best's ratings upon review of financial information concerning Contractor and insurance carrier. The Owner reserves the right to require that the Contractor's insurer(s) be a

licensed and admitted insurer(s) in the State of Nevada, or on the Insurance Commissioner's approved, but not admitted, list.

L. VERIFICATION OF COVERAGE

Prior to the commencement of any work on the project, the Contractor shall furnish the Owner with certificates of insurance and with original endorsements affecting coverage required. The certificates and endorsements for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and endorsements are to be received and approved by the Owner before work commences. The Owner reserves the right to require complete, certified copies of all required insurance policies, at any time should it be deemed in the best interest of the Owner.

M. SUBCONTRACTORS

The Contractor shall include all Subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each Subcontractor. All coverages for Subcontractors shall be subject to all of the requirements stated herein, except that if any Subcontractors maintain limits of insurance less than required in this Contract, Contractor's insurance shall include coverage for acts or omissions of Subcontractor up to the full limits required in this Contract.

N. MISCELLANEOUS CONDITIONS

1. The Contractor shall be responsible for and remedy all damage or loss to any property, including property of the Owner, caused in whole or in part by the Contractor, any Subcontractor, or any employed, directed or supervised by the Contractor.

2. Nothing herein contained shall be construed as limiting in any way the extent to which the Contractor may be held responsible for payment of damages to persons or property resulting from its operations or the operations of any Subcontractor under it.

3. In addition to any other remedies the Owner may have should the Contractor fail to provide or maintain any insurance policies or policy endorsements to the extent and within the time required, the Owner may, at its sole option:

    a. Purchase such insurance to cover any risk for which the Owner may be liable through the operations of the Contractor under this Contract and deduct or retain the amount of the premiums for such insurance from any sums due to the Contractor under the Contract; or

    b. Order the Contractor to cease work under this Contract and/or withhold any payments, which became due the Contractor until the Contractor demonstrates compliance with the requirements hereof; or

c. Terminate the Contract.

2. GUARANTEE BOND

Not Required for this Project.

3. INTEREST

Article 13.5 is hereby supplemented as follows:

Not Required for this Project.

4. CLEANING UP

Article 3.15 is hereby supplemented as follows:

The Contractor, at all times, shall keep the premises free from accumulation of waste materials or rubbish caused by operations. At the completion of the work, Contractor shall remove all waste materials and rubbish from and about the project as well as all tools, construction equipment, machinery and surplus materials, and shall clean all glass surfaces and leave the work "broom clean" or its equivalent, except as otherwise specified.

5. LIQUIDATED DAMAGES

Add Article 8.2.4 as follows:

It is hereby understood and mutually agreed that the date of beginning, rate of progress, and the time for completion of the work to be done hereunder are essential conditions of this Contract and that the work embraced in this Contract shall be commenced on the date set forth in the Notice to Proceed issued by the Owner.

The Contractor agrees that all work shall be performed regularly, diligently, and uninterruptedly at a rate of progress that will ensure substantial completion within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for completion of the work described herein is an acceptable time for the completion of the work. If the Contractor should neglect, fail, or refuse to complete the work within the specified Contract time, that has been extended by the Owner, then the Contractor does hereby agree, as a part of the consideration for receiving the award of this Contract, to pay to the Owner, not as a penalty, but as Liquidated Damages, the amount of money specified in the Contract (Section 00100 – Instruction to Bidders and Bid Form (PUR-F523) per day. If the Owner incurs costs in excess of the Liquidated Damages as a result of the Contractor's inability to complete the work by the specified date the additional cost will be deducted from the Contract amount.

If the Contractor fails to complete or correct the work listed on the comprehensive list of deficiencies ("**Punch-List**") within the specified time for performance, the Contractor does hereby agree to pay the Owner **$1,500** as Liquidated Damages for each calendar day that the completion or correction of the work extends beyond the

45 days for performance allowed from the date the Contractor receives the Punch List of deficiencies from the Architect and/or his/her consultants and/or the Owner.

6. CHANGE ORDERS

Article 7.2 is hereby modified as follows:

A. The Owner, without invalidating the contract, may order changes in the work consisting of additions, deletions, or other revisions, the contract sum and contract time being adjusted accordingly. All such changes in the work shall be authorized by Change Order issued by the Owner.

B. The cost or credit to the Owner resulting from a change in the work shall be determined by the Architect in one or more of the following ways:

1. By unit prices stated in the Contract documents or subsequently agreed upon.

2. By mutual acceptance of a lump sum proposal, properly itemized by contractor/subcontractor, to include the following:

   a. Labor, including fringe benefits, payroll taxes, and workers' compensation insurance;

   b. Materials entering permanently into the work;

   c. Equipment costs for equipment utilized to perform the Change Order work; and/or

   d. Change Order Mark-Up per Schedule.

3. By the actual cost of properly itemized by contractor/subcontractor, to include the following:

   a. Labor, including fringe benefits, payroll taxes, and workers' compensation insurance;

   b. Materials entering permanently into the work;

   c. Equipment costs for equipment utilized to perform the Change Order work; and/or

   d. Change Order Mark-Up per Schedule.

C. The costs under Paragraph 6(B) 1-3 above may be increased by General/Prime Contractor, Subcontractor (all tiers) to include a fixed fee for Subcontractor profit and overhead, Prime Contractor profit and overhead on Subcontractor work, and profit and overhead on work done by the General/Prime Contractor's own forces. The total of such fixed fee shall not exceed the amount determined from the Change Order Mark-Up Schedule below for a single Change Order item, or for

any group of related items, and shall be full compensation for the cost of supervision (to include Project Manager, Project Coordinator, Superintendent, Administrative Staff, etc.), overhead, profit, insurance, general conditions not listed and any BIM updating, Procore updating, or other general expense associated with completing the change in the scope of work. The allowable mark-up fee for contractor bonding shall be in addition to the fee below for the Prime Contractor only and shall not exceed 1% of the change if applicable.

CHANGE ORDER MARK-UP SCHEDULE

1. Additive Changes (for the entity performing the work):	
Total Cost of Change +$0.01 to +$50,000 +$50,000.00 and above	Allowable Fee 15% of the Total Cost 10% of the Total Cost
2. Additive Changes (Contractor Markup) Subcontractors work:	
Total Cost of Change +$0.01 to +$50,000 +$50,000.00 and above	Allowable Fee 10% of the Total Subcontractor Fee 5% of the Total Subcontractor Fee
3. Deductive Changes:	
Total Credit Cost of Change +$0.01 to +$50,000 +$50,000.00 and above	Credit Fee to be Applied 10% of the Total Subcontractor Cost. (*Deductive*) 5% of the Total Subcontractor Fee (Deductive)
Example of Deductive Change: Assume <$5,000.00> to be credited. The Contractor must include a 10% credit for profit and overhead, i.e. $5,000.00 X 0.10 = <$5,500.00> total credit to the Contract.	

D. No fees shall be paid for time extensions.

E. All proposals shall be submitted to the Architect in sufficient detail to complete an analysis of all costs. The Contractor shall submit invoices for materials and equipment utilized in Change Order work. Labor rates shall not exceed the applicable Wage Rates (including Prevailing Wage Rates) as published by the State of Nevada Office of the Labor Commissioner. Fringe benefits shall not exceed the cost of fringe benefits normally paid to such personnel or established by the industry in the Northern Nevada area, whichever is lower. Labor rates or additional rates not identified as part of Prevailing Wage Rates shall be identified and approved by WCSD prior to start of construction.

7. SUBCONTRACTORS

Article 5.2.1 is hereby modified as follows:

A. Per NRS Chapter 338:

1. Except as otherwise provided in Subsection 2, each bid submitted to any officer, department, board or commission for the construction of any public work or improvement must include:

   a. The name of each Subcontractor who will provide labor or a portion of the work or improvement to the Contractor for which he/she will be paid; and

   b. A description of the portion of the work or improvement which each Subcontractor named in the bid will complete.

2. The Contractor shall list in the Bid Form (PUR-F523) pursuant to Subsection 1 the name of a Subcontractor for each portion of the project that will be completed by him/her.

3. A Contractor whose bid is accepted, shall not substitute any person for a Subcontractor who is named on the Bid Form (PUR-523), unless:

   a. The Owner objects to the Subcontractor, requests in writing a change in the Subcontractor and pays any increase in costs resulting from the change; or

   b. The substitution is approved by the Owner and:

      1. The Subcontractor, after having a reasonable opportunity, fails or refuses to execute a written contract with the Contractor, which was offered to the Subcontractor with the same terms and conditions that all other Subcontractors on the project were offered; or

      2. The named Subcontractor files for bankruptcy or becomes insolvent; or

      3. The named Subcontractor fails or refuses to perform subcontract within a reasonable time.

8. MANDATORY DRUG TESTING PROGRAM

A. In order to be eligible to perform work on WCSD construction projects all Contractors who will work on such projects must have a current and valid Drug and Alcohol Policy that is applicable to all workers who will be employed on those projects regardless of tier. This requirement is a reasonable precaution to ensure a safe and drug-free environment on school construction projects that may involve workers being in relatively in close contact with students.

B. The Policy must meet the minimum requirements as outlined in Exhibit 1. Each Contractor shall demonstrate compliance with this provision by signature on the Bid Form that the Policy is in place, that it will be actively enforced, and that all workers who will be employed on WCSD projects will have undergone the pre-

placement drug testing required by WCSD. The WCSD and/or the Prime Contractor is empowered to review Contractor records of enforcement of its Drug and Alcohol Policy at any time during the construction period up to and including completion of the project in order to determine whether the policy is in fact being enforced. The Contractor shall forthwith deliver to the WCSD any and all records requested to determine compliance with this Drug and Alcohol Policy requirement. Failure to maintain or rigorously enforce the policy or to timely respond to WCSD demands for production of records relating to the Drug and Alcohol Policy may result in termination of the project agreement at no cost to the WCSD.

C. Refer to Washoe County School District Mandatory Drug and Testing Program Requirements – EXHIBIT 1.

EXHIBIT 1

WASHOE COUNTY SCHOOL DISTRICT

MANDATORY DRUG AND ALCOHOL TESTING PROGRAM REQUIREMENTS

In order to be eligible to perform work on WCSD construction projects, all Contractors who work on such projects must have a current and valid Drug and Alcohol Policy that meets the following minimum requirements:

1. A statement identifying prohibited conduct regarding employee drug and alcohol use. At a minimum, the policy should address the following areas of prohibited conduct:

    a. Alcohol

    Possession of open containers use or being under the influence of alcohol by any employee during normal business hours including lunch breaks, while performing Contractor business, while operating Contractor vehicles or equipment or while on company premises is prohibited. Failure to pass an alcohol test will be grounds for disciplinary action up to and including termination.

    b. Illegal Drugs

    The unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited. Failure to pass a drug test will be grounds for disciplinary action up to and including termination.

    c. Legal Drugs

    Except as provided below, use or being under the influence of any mood-altering legal drug by any employee while on company premises or while performing company business is prohibited to the extent such use or influence may affect the safety of the employee, co-workers or the public, the employee's job performance or the safe or efficient operation of the Contractor.
    An employee under the influence of a mood-altering legal drug has an obligation to inquire and determine whether the mood-altering legal drug he/she is taking

may or will affect his/her ability to safely and efficiently perform his/her job duties. If the employee is using a mood-altering legal drug at the direction of a physician, dentist or other licensed practitioner, the employee is required to inform a designated company official. In compliance with the Americans with Disabilities Act (ADA), this policy does not require the employee, physician, dentist or other licensed practitioner to identify the name of the prescription drug or the medical condition for who it is prescribed. For the safety of all employees, the Contractor may place persons using such drugs in a less hazardous job assignment or place them on temporary medical leave until released as fit for duty by the prescribing physician, dentist or other licensed practitioner. An employee taking over-the-counter medications contrary to instructions provided by the manufacturer may be subject to disciplinary action up to and including termination.

d. Drug Paraphernalia

Employee possession of drug paraphernalia on the project site is strictly prohibited.

2. A statement requiring, at a minimum, the following types of drug and/or alcohol testing:

a. Pre-Placement Testing

Prior to the start of employment generally, or employment on any WCSD project, the Contractor must assure that any employee assigned to work on a WCSD project has previously completed a pre-placement drug test before the effective date of the project assignment. In the case of a newly hired employee, he/she must pass a pre-placement drug test prior to being allowed to work on a WCSD project.

b. Reasonable Suspicion Testing

Contractor will require a medical examination, breath test, blood test, and/or urinalysis when there is reasonable suspicion to believe that the employee is using drugs and/or alcohol at work or where circumstances or workplace conditions justify it.

c. Post- Accident Testing

Each employee will be tested for prohibited drugs and alcohol use as soon as possible after a reportable accident. Reportable accident is defined as any incident that results in an employee requiring medical treatment that results in the filing of a Workers Compensation claim, or property damage in excess of five hundred dollars ($500.00). An employee shall not be relieved of duty pending the receipt of test results except where there is reasonable evidence that alcohol or illegal drug use was a contributing factor as determined by the treating physician.

d. Return To Duty Testing and Follow-Up Testing

At the Contractor's discretion, employees in violation of the drug and alcohol

policy will be subject to a return to duty policy as a condition of continued employment. In essence, this policy states that the Contractor may rehire or retain the employee in return for the employee's promise to remain alcohol and drug free on WCSD project sites, complete an evaluation by a licensed alcohol and drug counselor and follow all professional recommendations, provide a negative drug and/or alcohol test to return to duty and submit to follow-up testing on a random basis to confirm on-going policy compliance. This document will be kept in a confidential file belonging to the Contractor's agency.

3. A statement describing the procedures the Contractor will use to test for the presence of alcohol and controlled substances, protect the integrity of the testing processes, safeguard the validity of the test results and ensure that those results are attributed to the correct employee. To meet this requirement, the Contractor is encouraged to follow the Federal Substance Abuse and Mental Health Services Administration (SAMHSA) Drug and Alcohol Testing Guidelines (49 CFR Part 40). At a minimum, the employer must test for the following drugs of abuse:

    - Marijuana
    - Cocaine
    - Opiates
    - Amphetamines/Methamphetamines
    - Phencyclidine (PCP)

    a. For the purpose of this policy, a positive drug test means that the employee has ingested a drug(s), which causes the employee's drug threshold level to be above the Federal Substance Abuse and Mental Health Services Administration (SAMHSA) Drug and Alcohol Testing Guidelines (49 CFR Part 40). For the purpose of this policy an employee whose breath/blood alcohol level is .04 or greater is considered to be in violation of the policy. It is recommended that blood alcohol testing only be used when an employee is medically unable to provide a breath alcohol sample.

4. A statement indicating the consequences for employees found to be in violation of the drug and alcohol policy. The Contractor's policy must outline the procedures the Contractor will follow to assure that the employee is fit to return to duty following a policy violation. At a minimum, an employee in violation of the Contractor's drug and alcohol policy must complete an evaluation by a licensed alcohol and drug counselor and follow all professional recommendations, provide a negative drug and/or alcohol test to return to duty and submit to follow-up testing on a random basis to confirm on-going policy compliance.

5. A statement indicating that actions taken under this policy will be confidential within the affected Contractor and employee. At a minimum, the Contractor must inform the employee that test results may be disclosed to another member of management on a need-to-know basis and to the employee upon request. Disclosures, without employee consent may also occur when: (A) the information is compelled by law or judicial or administrative process; (B) the information has been placed at issue in a formal dispute between the employer and the employee or job applicant; (C) the information is used in administering an employee benefit plan or other insurance program; (D) the information

is needed by first-aid, safety, or medical personnel for the diagnosis or treatment of an employee who is unable/unwilling to authorize disclosure; (E) for review by the State Worker's Compensation Board or the State Unemployment Security Division in determining a pending claim; or (F) the information is compelled by federal officials investigating compliance with the Americans with Disabilities Act (ADA).

6. A statement indicating that all employees shall participate in a company-sponsored drug/alcohol awareness program. The program shall provide employees with information regarding: (A) the company's drug/alcohol free workplace policy; (B) available counseling, referral agencies and rehabilitation; and (C) the penalties imposed upon employees for violations of this policy.

   Each Contractor shall ensure that all supervisors designated to supervise employees on a WCSD project complete a training course on reasonable suspicion testing. This training shall include information on the physical, behavioral, speech and performance indicators of probable employee alcohol or drug abuse and how to effectively intervene per Contractor policy.

7. A statement indicating that Subcontractors, Sub-tiered Contractors, vendors, and their employees shall be required to cooperate with the Contractor's policy to achieve a drug/alcohol free workplace.

END OF EXHIBIT 1

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9. ARTICLE 1.1 GENERAL PROVISIONS

Add the following at the end of Subparagraph 1.1.1:

In the event of any conflict among the Contract documents, the documents shall be construed according to the following priorities:

Highest Priority:	Modifications
Second Priority:	Agreement
Third Priority:	Addenda–later date to take precedence
Fourth Priority:	Supplementary General Conditions
Fifth Priority:	General Conditions
Sixth Priority:	Specifications with respect to quality and general performance of the Work
Seventh Priority:	Drawings with respect to quantity of materials and general location of the Work. Detail drawings shall take precedence over small scale drawings.

Add the following at the end of Subparagraph 1.2.1:

All Work mentioned or indicated in the Contract documents shall be performed by the Contractor as part of this Contract unless it is specifically indicated in the Contract documents that such Work is to be done by others. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work unless otherwise directed by written addendum to the Contractor.

Add the following to Subparagraph 1.2.2:

The Contractor and all Subcontractors shall refer to all of the Drawings, including those showing primarily the Work of the mechanical, electrical and other specialized trades, and to all of the Sections of the Specifications, and shall perform all Work reasonably inferable therefrom as being necessary to produce the indicated results.

Add new Subparagraphs 1.2.4 through 1.2.11 as follows:

1.2.4 All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract documents.

1.2.5 Where codes, standards, requirements and publications of public and private bodies are referred to in the Specifications, references shall be understood to be to the latest adopted version used to issue permits, except where otherwise indicated.

1.2.6 Where no explicit quality or standards for materials or workmanship are established for Work, such Work is to be of good quality for the intended use and consistent with the quality of the surrounding Work and of the construction of the Project generally.

1.2.7 All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract documents.

1.2.8 The Mechanical, Electrical and Fire Protection Drawings are diagrammatic only, and are not intended to precisely show the alignment, physical locations or configurations of such Work. Such Work shall be installed without additional cost to the Owner to clear all obstructions, permit proper clearances for the Work of other trades, and present an orderly appearance where exposed. Prior to beginning such Work, the Contractor shall prepare coordination drawings showing the exact alignment, physical location and configuration of the Mechanical, Electrical and Fire Protection installations and demonstrating to the Contractor's satisfaction that the installations will comply with the preceding sentence.

1.2.9 Exact locations of fixtures and outlets shall be obtained from the Architect as provided in Subparagraph 3.2.2 before the Work is roughed in; Work

installed without such information from the Architect shall be relocated at the Contractor's expense.

1.2.10 Test boring or soil test information included with the Contract documents or otherwise made available to the Contractor was obtained by the Owner for use by the Architect in the design of the Project or Work. The Owner does not hold out such information to the Contractor as an accurate or approximate indication of subsurface conditions, and no claim for extra cost or extension of time resulting from reliance by the Contractor on such information shall be allowed except as provided in Subparagraph 3.7.4.

1.2.11 Where the Work is to fit with existing conditions or work to be performed by others, the Contractor shall fully and completely join the Work with such conditions or work, unless otherwise specified.

11. ARTICLE 3.1 CONTRACTOR

Add the following to the end of 3.2.1:

If the Contractor proceeds with the Work without such notice to the Architect, having discovered such errors, inconsistencies or omissions, or if by reasonable study of the Contract documents the Contractor could have discovered such, the Contractor shall bear all costs arising therefrom.

Add the following to the end of 3.2.2:

The Contractor shall give the Architect timely notice of any additional Drawings, Specifications, or instructions required to define the Work in greater detail or to permit the proper progress of the Work. The Contractor shall not proceed with any Work not clearly and consistently defined in detail in the Contract documents but shall request additional Drawings or instructions from the Architect. If the Contractor proceeds with such Work without obtaining further Drawings, Specifications or instructions, then the Contractor shall correct Work incorrectly done at the Contractor's own expense.

Add the following sentence to the end of Subparagraph 3.4.1:

The word "provide" shall mean furnish and install complete, including connections, unless otherwise specified.

Change the first sentence of Subparagraph 3.5.1 and delete the last (2) two sentences to read as follows:

The Contractor warrants that the materials and equipment furnished under the Contract will be new and of recent manufacture unless otherwise specified, and that all Work will be of good quality, free from faults and defects, and in conformance with the Contract documents.

Add new Subparagraphs 3.5.3 through 3.5.9 as follows:

3.5.3 The Contractor shall be responsible for determining that all materials furnished for the Work meet all requirements of the Contract documents. The Architect may require the Contractor to produce reasonable evidence that a material meets such requirements, such as certified reports of past tests by qualified testing laboratories, reports of studies by qualified experts, or other evidence which, in the opinion of the Architect, would lead to a reasonable certainty that any material used, or proposed to be used, in the Work meets the requirements of the Contract documents. All such data shall be furnished at the Contractor's expense. This provision shall not require the Contractor to pay for periodic testing of different batches of the same material, unless such testing is specifically required by the Contract documents to be performed at the Contractor's expense.

3.5.4 If the Contractor proposes to use a material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract documents, the Contractor shall inform the Architect in writing of the nature of such deviations at the time the material is submitted for approval and shall request written approval of the deviation from the requirements of the Contract documents.

3.5.5 In requesting approval of deviations or substitutions, the Contractor shall provide, upon request, evidence leading to a reasonable certainty that the proposed substitution or deviation will provide a quality of result at least equal to that otherwise attainable. If, in the opinion of the Architect, the evidence presented by the Contractor does not provide a sufficient basis for such reasonable certainty, the Architect may reject such substitution or deviation without further investigation.

3.5.6 The Contract documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect shall judge the design and appearance of proposed substitutes based on their suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Architect will not approve as equal to materials specified proposed substitutes which, in the Architect's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character of quality of design of the Project. In order to permit coordinated design of color and finishes the Contractor shall, if required by the Architect, furnish the substituted material in any color, finish, texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the Owner.

3.5.7 Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the Contractor, notwithstanding approval or acceptance of such substitution by the Owner or the Architect, unless such substitution was made at the written request or direction of the Owner or the Architect.

3.5.8 The warranty provided in this Paragraph 3.5 shall be in addition to and not in limitation of any other warranty required by the Contract documents or otherwise prescribed by law.

3.5.9 The Contractor shall procure and deliver to the Architect, no later than the date claimed by the Contractor as the date of Substantial Completion, all special warranties required by the Contract documents. Delivery by the Contractor shall constitute the Contractor's guarantee to the Owner that the warranty will be performed in accordance with its terms and conditions.

Change the title of Paragraph 3.9 to read "Superintendence."

Change the first sentence of Subparagraph 3.9.1 to read as follows:

The Contractor shall employ a competent superintendent, reasonably acceptable to the Owner, and necessary assistants who shall be in attendance at the Project site full time during the progress of the Work until the date of Substantial Completion, and for such additional time thereafter as the Architect may determine to be necessary for the expeditious completion of the Work.

Add to end of Subparagraph 3.9.3 as follows:

The Contractor shall remove the superintendent if requested to do so in writing by the Owner and shall promptly replace him with a competent person reasonably acceptable to the Owner.

Add new Subparagraphs 3.9.4 through 3.9.7 as follows:

3.9.4 The Contractor shall retain a competent Registered Professional Engineer or Registered Land Surveyor, acceptable to the Architect, who shall establish the exterior lines and required elevations of all buildings and structures to be erected on the site and shall establish sufficient lines and grades for the construction of associated Work such as, but not limited to, roads, utilities, and site grading. The Engineer or Land Surveyor shall certify as to the actual location of the constructed facilities in relation to property lines, building lines, easements, and other restrictive boundaries.

3.9.5 The Contractor shall establish the building grades, lines, levels, columns, walls and partition lines required by the various Subcontractors in laying out their Work.

3.9.6 The Contractor shall coordinate and supervise the Work performed by Subcontractors to the end that the Work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the Work. The Contractor and all Subcontractors shall at all times afford each trade, any separate contractor, or the Owner, every reasonable opportunity for the installation of work and the storage of materials.

3.9.7 The Contractor shall arrange for and attend job meetings with the Architect and such other persons as the Architect may from time-to-time wish to have present. The Contractor shall be represented by a principal, project manager, general superintendent or other authorized main office representative, as well as by the Contractor's own superintendent. An authorized representative of any Subcontractor or Sub-Subcontractor shall attend such meetings if the representative's presence is requested by the Architect. Such representatives shall be empowered to make binding commitments on all matters to be discussed at such meetings, including costs, payments, change orders, time schedules, and workforce. Any notices required under the Contract may be served on such representatives.

Change Subparagraph 3.10.1 to read as follows:

3.10.1 The Contractor shall prepare and submit to the Architect a progress schedule as described in Subparagraphs 8.2.4 through 8.2.10.

Change Subparagraph 3.12.6 to read as follows:

3.12.6 By approving and submitting Shop Drawings, Product Data, Samples, and similar submittals the Contractor thereby represents that the Contractor has determined and verified all dimensions, quantities, field dimensions, relations to existing work, coordination with work to be installed later, coordination with information on previously accepted Shop Drawings, Product Data, Samples, or similar submittals and verification of compliance with all the requirements of the Contract documents. The accuracy of all such information is the responsibility of the Contractor. In reviewing Shop Drawings, Product Data, Samples, and similar submittals the Architect shall be entitled to rely upon the Contractor's representation that such information is correct and accurate.

Add the following at the end of Subparagraph 3.12.9:

Unless such written notice has been given, the Architect's approval of a resubmitted Shop Drawing, Product Data, Sample, or similar submittal shall not constitute approval of any changes not requested on the prior submittal.

Change Subparagraph 3.13 to read as follows:

The right of possession of the premises and the improvements made thereon by the Contractor shall remain at all times with the Owner. The Contractor's right to entry and use thereof arises solely from the permission granted by the Owner under the Contract documents. The Contractor shall confine the Contractor's apparatus, the storage of materials, and the operations of the Contractor's workmen to limits indicated by law, ordinances, the Contract documents and permits and/or directions of the Architect and shall not unreasonably encumber the premises with the Contractor's materials. The Owner shall not be liable to the Contractor, their Subcontractors, their employees or anyone else with respect to the conditions of the premises, except only for a condition caused directly and

solely by the negligence of the Owner.

Add the following at the end of Subparagraph 3.15.1:

Immediately prior to the Architect's inspection for Substantial Completion, the Contractor shall completely clean the premises. Concrete and ceramic surfaces shall be cleaned and washed. Resilient coverings shall be cleaned. Woodwork shall be dusted and cleaned. Sash, fixtures, and equipment shall be thoroughly cleaned. Stains, spots, dust, marks and smears shall be removed from all surfaces. Hardware and all metal surfaces shall be cleaned and polished. Glass and plastic surfaces shall be thoroughly cleaned by professional window cleaners. All damaged, broken or scratched glass or plastic shall be replaced by the Contractor at the Contractor's expense.

12. ARTICLE 4.1 ADMINISTRATION OF THE CONTRACT

In Subparagraph 4.2.7, add to the end of the first sentence:

"…and only to the extent which the Architect believes desirable to protect the Owner's interest."

13. ARTICLE 8.1 TIME

Added new Subparagraphs 8.1.5 through 8.1.11 as follows:

8.1.5 Within two (2) weeks after award of the Contract, the Contractor shall submit to the Architect a Progress Schedule showing for each class of work included in the Schedule of Values, the percentage completion to be obtained and the total dollar value of work to be completed as of the first of each month until Substantial Completion. All calculations shall be based on the Work in place, and not include the value of materials delivered, but not in place.

8.1.6 The Progress Schedule shall be based on an orderly progression of the Work, allowing adequate time for each operation (including adequate time for submission and review of submittals), and leading to a reasonable certainty of Substantial Completion by the date established in the Agreement. The Progress Schedule will be reviewed by the Architect for compliance with the requirements of this Article and will be accepted by the Architect or returned to the Contractor for revision and resubmittal. Unless specifically required by law, no payment under this Contract shall be due until the Progress Schedule has been approved by the Architect.

8.1.7 If in any Application for Payment the total value of the completed Work in place, as certified by the Architect, is less than 90% of the total value of the Work in place estimated in the Progress Schedule, the Owner may, at the Owner's option, require the Contractor to accelerate the progress of the Work without cost to the Owner by increasing the work force of hours of work, or by other reasonable means approved by the Architect.

8.1.8 If each of three (3) successive applications, as certified by the Architect, indicate that the actual Work completed is less than 90% of the values estimated in the Progress Schedule to be completed by the respective dates, the Owner may at the Owner's option, treat the Contractor's delinquency as a default justifying the action permitted under Paragraph 14.2.

8.1.9 If the Architect has determined that the Contractor should be permitted to extend the time for completion as provided in Paragraph 8.3, the calendar dates in the Progress Schedule shall be adjusted accordingly to retain the same relationship to the adjusted date of Substantial Completion, and the dollar value of Work to be completed as of the first of each month shall be prorated.

8.1.10 If the Contractor fails to submit any Application for Payment in any month, the Architect shall, for the purpose of this evaluation of progress, certify separately to the actual value of the Work in place completed as of the first of the month to the best of the Architect's knowledge.

8.1.11 Nothing herein shall limit the Owner's right to liquidated or other damages for delays by the Contractor or to any other remedy which the Owner may possess under other provisions of the Contract Documents or by law.

Change Subparagraph 8.3.3 and add new Subparagraph 8.3.4 as follows:

8.3.3 No claim for delay shall be allowed on account of failure of the Architect to furnish Drawings, Specifications, or instructions or to return Shop Drawings or Samples until fifteen (15) days after receipt by the Architect by registered or certified mail of written demand for such instructions, Drawings, or Samples, and not then unless such claim be reasonable.

8.3.4 The Contractor hereby agrees that the Contractor shall have no claim for damages of any kind against the Owner or the Architect on account of any delay in the commencement of the Work and/or any delay or suspension of any portion of the Work, whether such delay is caused by the Owner, the Architect, or otherwise. The Contractor acknowledges that the Contractor's sole remedy for any such delay and/or suspension will be an extension of time as provided in this Article.

14. ARTICLE 9.1 PAYMENTS AND COMPLETION

Add at the end of the second sentence of Subparagraph 9.2:

"and shall be revised if later found by the Architect to be inaccurate."

Add new Subparagraph 9.3.4 as follows:

9.3.4 Each Application for Payment or periodic estimate requesting payment shall at the Owner's option be accompanied by: (1) a waiver of liens from each Subcontractor; or (2) a certificate from each Subcontractor stating that the

Subcontractor has been paid all amounts due the Subcontractor on the basis of the previous periodic payment to the Contractor or else stating the amount not so paid and the reason for the discrepancy. In the event of any such discrepancy, the Contractor shall furnish the Contractor's own written explanation to the Owner through the Architect. Such waiver or certificate shall be in a form acceptable to the Owner.

In Subparagraph 9.5.1, add the new item to the list of .1 through .7 as follows:

.8 failure of mechanical trade or electrical trade Subcontractors to comply with mandatory requirements for maintaining record drawings. The Contractor shall check record drawings each month. Written confirmation that the record drawings are current will be required by the Architect before approval of the Contractor's monthly payment requisition.

Replace the second sentence of Subparagraph 9.10.2 with the following:

If the Contractor fails to furnish such releases or waivers, as the Owner reasonably requires, to satisfy the Owner that there are not outstanding liens, the Owner may require the Contractor, as a condition of final payment and at the Contractor's expense, to furnish a bond satisfactory to the Owner to indemnify the Owner against any such liens.

15. ARTICLE 10.1 PROTECTIONS OF PERSONS AND PROPERTY

At the end of the Subparagraph 10.1, add the following:

"… including compliance with 29 CFR 1910.132, 1910.133, and 1910.134, and for providing a safe workplace and complying with all codes, bylaws, rules and regulations applicable to the construction site."

In Subparagraph 10.2.1.2 delete the word "and" at the end of the Subparagraph.

In Subparagraph 10.2.1.3 add the word "and" to the end of the Subparagraph.

In Subparagraph 10.2.1, add the new item to the list of .1 through .3 as follows:

.4 any other property of the Owner, whether or not forming part of the Work, located at the site or adjacent thereto in areas to which the Contractor has access.

Add new Subparagraphs 10.2.9 through 10.2.12 as follows:

10.2.9 The Contractor shall provide and maintain in good operating condition suitable and adequate fire protection equipment and services and shall comply with all reasonable recommendations regarding fire protection made by the representatives of the fire insurance company carrying insurance on the Work or by the local Fire Chief or Fire Marshal. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.

10.2.10 The Contractor shall, at all times, protect excavations, trenches, buildings and materials, from rainwater, ground water, backup or leakage of sewers, drains and other piping, and from water of any other origin and shall remove promptly any accumulation of water. The Contractor shall provide and operate all pumps, piping, and other equipment necessary to this end.

10.2.11 The Contractor shall remove snow and ice which might result in damage or delay.

10.2.12 During the progress of the Work and at all times prior to the date of Substantial Completion of occupancy of the Work by the Owner, whichever is earlier, the Contractor shall provide temporary heat, ventilation, and enclosure, adequate to permit the Work to proceed in a timely fashion, and to prevent damage to completed Work or Work in progress, or to materials stored on the premises. The permanent heating and ventilation systems may be used for these purposes when available unless otherwise provided in the Contract Documents.

16. ARTICLE 11.3 PROPERTY INSURANCE

Subparagraphs 11.2.2 through 11.5.2 shall be deleted in their entirety.

17. ARTICLE 12.1 UNCOVERING AND CORRECTION OF WORK

Add at the end of Subparagraph 12.2.1:

"…and any cost, loss, or damages to the Owner resulting from such failure or defect."

18. ARTICLE 13.1 MISCELLANEOUS PROVISIONS

Change Subparagraph 13.4.4 to read as follows:

13.5.4 The Contractor shall obtain and deliver promptly to the Architect any occupancy permit and any certificates of final inspection of any part of the Contractor's work and operating permits for any mechanical apparatus, such as elevators, escalators, boilers, air compressors, etc., which may be required by law to permit full use and occupancy of the premises by the Owner. Receipt of such permits or certificates by the Architect shall be a condition precedent to Substantial Completion of the Work.

19. ARTICLE 14.1 TERMINATION OF THE CONTRACT

Delete "or" from end of Subparagraph 14.1.1.2

Delete Subparagraphs 14.1.1.4 in its entirety.

20. ARTICLE 15 CLAIMS AND DISPUTES

Add the following sentence to the end of Subparagraph 15.1.3.1:

Any change or addition to a previously made Claim shall be made by timely written notice in accordance with this Subparagraph 15.1.3.1.

Delete the second sentence of Subparagraph 15.1.6.1 and substitute the following:

The Contractor shall have the burden of demonstrating the effect of the claimed delay on the Contract Time and shall furnish the Architect with such documentation relating thereto as the Architect may reasonably require.

Add the following Subparagraph:

15.1.6.3 Any extension of time for weather delays shall be considered by the Architect and Owner only when a request for such extension is made in writing by the Contractor and provided further that any such request shall be presented to the Architect or Owner within ten (10) days from the commencement of the period of delay.

It is expressly understood and agreed that the Contract Time includes adequate time to allow for usual weather/smoke delays considering the climatic conditions in the area of the Project. No adjustments to the Contract Time will be allowed on account of usual weather or subsequent building/site conditions. The Contractor shall include adequate float or other allowance in the Contractors construction schedule to accommodate weather conditions that may be associated with weather dependent work. Any extension of time for weather will be per specifications 01310(A/B).

Time extension requests for delays caused by additional adverse weather conditions will be evaluated individually. Inclement weather days in which no work is conducted at the project site will be considered by the Owner for full day time extensions. Inclement weather days in which any trade or worker perform work on the project will be considered by the Owner for a maximum of one-half (½) daytime extension.

SECTION 00810 – WAGE RATES AND APPRENTICE UTILIZATION

The Contractor shall comply strictly with the requirements of **NRS Chapter 338** and shall pay, if required by statute, prevailing wage rates for the appropriate labor positions as outlined in 'Washoe County - Prevailing Wage Rates for Public Works, State of Nevada" for projects that are $100,000 or greater. Prevailing wage shall be paid for all work through punch list and issuance of Notice of Completion.

Wage rates as published by the Labor Commissioner of the State of Nevada are available as follows:

Office of Labor Commissioner
1818 College Parkway, Suite 102
Carson City, NV 89706

- Phone: (775) 684-1890
- Email: mail1@Labor.nv.gov
- Website: https://labor.nv.gov/

The Contractor shall comply strictly with the requirements of **NRS Chapter 338 and the Apprentice Utilization Act** as reformed by Senate Bill 82 (SB82) in the 2023 Legislative Session effective January 1, 2024. Please refer to the Labor Commissioner's website specifically for a copy of Senate Bill 82, Presentation Senate Bill 82 dated 12-12-23, Senate Bill 82 OLC Summary dated 12-12-23 and any other posted information.

(https://labor.nv.gov/Apprenticeship_Utilization_Act/Apprenticeship_Utilization_Act/)

A contractor or subcontractor engaged in Public Works construction who employs workers on one or more public works during a calendar year pursuant to NRS 338.040 shall use apprentices for a portion of the total hours of labor worked for each apprenticed craft or type of work to be performed on those public works.

This project is subject to the Apprentice Utilization Act and is categorized as **VERTICAL** work.

It is the Contractor's responsibility to comply, document and report directly to the Labor Commissioner annually if they have performed a certain number of hours or more on Public Works. Failure to comply, document and report could result in financial penalties and disqualification per NRS.

SECTION 00820 - SPECIAL CONDITIONS

1. TIME OF COMPLETION

The physical work is to commence upon issuance of a Notice to Proceed and shall be completed on or before **October 28, 2027.**

2. EXAMINATION OF SITE

Contractor is requested to visit the project site, compare the Drawings and Specifications with any work in place, and be informed of all conditions, including the work, if any, being performed. Failure to visit the project site will in no way relieve the Contractor from necessity of furnishing any materials or performing any work in accordance with Drawings and Specifications that may be required to complete the work without additional cost to the Owner.

The Contractor shall call the project site and make arrangements for a time to visit. To review the existing premises, contact the Principal and/or Site Facilities Coordinator at the site(s). **Whenever at the site, be sure to check in at the Front Office**.

3. STORAGE

If available as determined by the Capital Projects Department, the Contractor may make arrangements with the Capital Projects Department for an area which the Contractor may use for storage of tools, equipment, and supplies while the project is in progress. Contractor to provide own storage unit for self and any Subcontractors.

4. UTILITIES

All work within an existing facility and if available as determined by the Capital Projects Departments, the Contractor may make arrangements with the Capital Projects Department for the use of all water, electricity, lighting, and other utilities necessary for construction purposes. However, the Contractor shall furnish at his/her own expense any lines or equipment, or extensions necessary to bring utilities to construction areas including any design, permitting, fees, hookup, etc. to execute the use of the utility.

5. TOILETS

If available as determined by the Capital Projects Department, the Contractor may make arrangements with the Capital Projects Department for toilets as necessary for use of workers. Toilets must be kept in sanitary condition and are the responsibility of the Contractor. Additional toilets may be required to be provided by the Contractor if weekend or after hour work is anticipated.

6. BUILDING CODES

All work in this project shall strictly comply with ordinances and laws, state and local, governing such construction in this locality.

Should the Drawings and/or Specifications in any way conflict with these ordinances and laws, the Contractor shall immediately notify the Owner.

7. WAGES

a. Wage Rates – The Contractor shall comply strictly with the requirements of NRS Chapter 338 and shall pay, if required by statute, prevailing wage rates for the appropriate labor positions as outlined in "Washoe County - Prevailing Wage Rates for Public Works, State of Nevada" for projects that are $100,000 or greater

b. Nondiscrimination - In connection with the performance of the work under this Contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, creed, color, national origin, or sex. Such agreement shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment, or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The Contractor further agrees to insert this provision in all subcontracts hereunder, except subcontract for standard commercial supplies or raw materials. Any violation of these provisions by a Contractor or Subcontractor shall constitute a material breach of Contract.

c. Health and Safety in Employment - All applicable provisions of NRS Chapter 618 shall be incorporated in the construction practices for all employees directly engaged in the completion of this project.

Safety: In accordance with generally accepted construction practices, the Contractor will be solely and completely responsible for condition of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours.

The duty of the Engineer/Architect to conduct construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures.

d. Hours - No overtime or weekend work on the project will be performed without the written approval of the Owner or Owner's representative except in cases of emergency where life or property is in imminent danger. The Contractor may submit a request for overtime, weekend or holiday work to the Capital Projects Department for review and approval or denial, a minimum of one (1) week prior to such work. It shall be the Contractor’s responsibility to pay, as a Deductive Change Order, any overtime costs associated with such work for WCSD personnel to open/close site, provide quality assurance and quality

control for such work.

WCSD has the right to reject any overtime, holiday or weekend work.

No person shall be employed for more than eight (8) hours in any one day or more than forty (40) hours in any one week without proper overtime compensation being paid.

During occupied periods, the Contractor can only work with the WCSD's permission. During these occupied periods, the Contractor will be responsible for the complete clean-up and weatherproofing of any work each day in order that the space can be utilized for its educational purpose the next day.

The cost of these "off" hours shall be included in the bid.

Work on the STEAM and Media Center building can occur from 7:00 a.m. until 5:00 p.m. Monday through Friday.

When School is **Not in Session**: From 7:00 a.m. until 3:30 p.m. Monday through Friday the site will be available to the Contractor.

When School is **In Session**: From 3:30 p.m. until 11:00 p.m. Monday through Friday the site will be available to the Contractor.

e. Employment – Contractors shall comply with NRS Chapter 338.125 and Chapter 338.130 inclusively. The Contractor expressly agrees to comply with the provisions of Chapter 338.130 and further agrees that if those provisions are not complied, or any failure or refusal to comply with the provisions of Chapter 338.130, shall render this Contract VOID.

f. Statutes - All applicable provisions of NRS Chapter 338 shall apply to this project and Contract and all Contractor and Subcontractors shall comply therewith.

g. Workers' Compensation - Workers' Compensation premiums shall be paid as required by law for the duration of the Contract practices delineated under "Occupational Safety and Health" (NRS Chapter 618) and will be adhered to in all phases of construction.

8. PERMITS AND INSPECTIONS

a. Since the project site is within Washoe County, City of Reno or City of Sparks, the Contractor shall secure a building permit and arrange for all inspections through the appropriate jurisdiction. WCSD is not exempt from the requirements of these authorities.

b. Any fees charged by Washoe County, City of Reno, or City of Sparks, for permanent improvements plan checking, permits; and water, sewer, electrical hook-up will be paid by WCSD. The Contractor shall be responsible for all temporary use permits and associated fees, including but not limited to,

discharge permits, dust control, encroachment, street cut, traffic control, and confined space, fire, elevator, etc. Contractor is responsible for all permit conditions, inspections, and final condition work.

c. The Contractor shall give all notices as required and comply with all laws, ordinances, rules, and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the Specifications and/or Drawings are at variance therewith, the Contractor shall notify the Owner promptly in writing, of any necessary changes in the work. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules, and regulations, and without such notice to the Owner, the Contractor shall bear all costs arising therefrom.

d. Deferred submittal coordination is the Contractor's responsibility including scheduling and timing with the permitting agency. Contractor may elect to submit under separate permit at their own expense, including any design, fees, review and submittal costs, and inspection fees as a result of additional permits.

e. The Contractor shall notify the Owner when ready for final inspection.

f. Final payment shall not be made until all the closed out permits for the work have been turned over to the Owner.

9. EMPLOYEE REGULATIONS

The Contractor shall, at all times, enforce strict discipline and good order among employees and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him.

The Contractor shall ensure that each and every kind of work shall be performed by workmen, laborers, or mechanics especially skilled in the class of work (trade) required and that workmanship shall be of the best trade practice, regardless of the quality of materials.

The Contractor shall provide, at all times, sufficient and competent labor to carry on the work properly and ensure completion of each part in accordance with schedule and within the time agreed to.

An employee of the Contractor or Subcontractor, who is deemed incompetent, disorderly, or otherwise objectionable by the Owner, shall be removed promptly by the Contractor, and not reemployed on the work.

10. MANUFACTURER'S SPECIFICATIONS AND RECOMMENDATIONS

Wherever, in these specifications, a particular brand or make of item is specified, the Contractor shall comply strictly with the specifications and recommendations of that manufacturer as to the installation and/or application of that particular item.

11. REFERENCE TO SPECIFICATIONS AND TRADE NAMES

In these Specifications, wherever American Society for Testing Materials or other specifications or standards are mentioned it shall be understood that the materials or methods mentioned therewith shall conform to all requirements of the issue in effect on date of submission of bids. In these specifications whenever the trade name of a product or the name of a product or the name of a manufacturer appears it shall be understood to specify the product so identified or its "Approved Equal." The words "Or Equal" or "Approved Equal" shall mean equal in the opinion of and approved by the Owner or its representative. Refer to requirements outlined in Section 01631 - SUBSTITUTIONS.

12. NOTIFICATION TO CONTRACTOR OF WORK TO BE PERFORMED

After award of the bid, the project shall be initiated by the successful execution of a Contract and a “Notice to Proceed” has been issued by the WCSD’s Purchasing Department.

13. GUARANTEE

The Contractor shall guarantee all work and equipment provided under this Contract to be free from defects of workmanship and material for a period of **one (1) year** or as specified, from the date of final acceptance of the work, which constitutes the issuance of a Notice of Substantial Completion and shall, at Contractor’s own expense, repair and replace all defective work and materials.

14. APPEAL BY UNSUCCESSFUL BIDDER

Any unsuccessful Bidder (Appellant) may appeal the results in the solicitation’s RECOMMENDATION OF AWARD TABULATION if they believe applicable provisions of the law were violated.

Appellant must submit a notice of protest to the Director of Procurement and Contracts no later than five (5) business days beginning the day after the date of the ROA TABULATION.

The notice of protest must include a written statement setting forth with specificity the reasons the person filing the notice believes the applicable provisions of the law were violated.

Appellant shall submit with the notice of protest a bond (i.e., Protest Bond or Appeal Bond) with a good and solvent surety company, authorized to do business in the State of Nevada or submit other security in a form approved by WCSD, who will hold the bond or other security until a determination is made on the appeal.

The bond shall be in the amount of twenty-five percent (25%) of the total dollar value of the Appellant’s bid submission, up to a maximum amount of two hundred fifty thousand dollars ($250,000).

If Appellant is not satisfied with WCSD's Director of Procurement and Contracts' response, Appellant may then appeal to an appeals committee designated by WCSD.

If Appellant is not satisfied with the appeals committee's response, Appellant may then appeal to WCSD's Board of Trustees, who will render the final decision. WCSD will postpone any award action until after WCSD's Board of Trustees renders a final decision.

Appellant will not seek any type of judicial intervention until WCSD has rendered its final decision on the protest.

If an appeal is granted, the full amount of the posted bond will be returned to Appellant.

If the appeal is denied/not upheld, a claim may be made against the bond by WCSD for expenses suffered by WCSD as a result of the unsuccessful appeal.

WCSD is not liable for any costs, expenses, attorney's fees, loss of income, or other damages sustained by Appellant in an appeal process.

15. QUALITY ASSURANCE

It shall be the Contractor's responsibility to use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work.

16. OTHER PROJECTS

The Contractor is hereby informed that other projects may be happening at the school/ site at the same time as this project. The Contractor will make every effort to coordinate work with that of other Contractors.

17. EXISTING BUILDING AND CONDITIONS

During construction, it shall be the responsibility of the Contractor to take all reasonable precautions to preserve and protect surrounding buildings and property from damage of all kinds arising from the execution of this Contract. He/she shall repair and/or be responsible for any such damage at no additional cost to the Owner.

It is the Contractor's responsibility to identify and document any building or site damage that exists prior to the start of construction. If undocumented damage is discovered by the Owner that could have been caused as a result of the Contractor's presence it will be the Contractor's responsibility to repair the damage to the Owner's satisfaction without cost to the Owner. If the Contractor does not repair the damage to the Owner's satisfaction, then the Owner has the right after forty-eight (48) hours of written notification to repair the damage and process an Owner's Deductive Change Order for all expenses associated with the repair.

The Contractor shall provide temporary protective fencing or covering over any open trenching or excavation arising from the execution of this Contract, to keep out unauthorized persons, at no additional cost to the Owner.

The Contractor shall notify the Capital Projects Department's representative forty-eight (48) hours prior to any electrical shutdowns at the project site. Failure to do so could cause freezing and other damage due to shut down of the energy management system. The Contractor shall bear all costs for damage resulting from any failure to notify designated parties.

The Contractor shall meet with the representative of the Capital Projects Department to establish limits of work and general ground rules. As school may be in session, all safety precautions will be rigidly enforced.

Contractor shall hire a qualified, properly Licensed Contractor to test all natural gas lines within area of work for leaks prior to the start of the project and at project completion. Note all gas leaks at the start of the project and report it to the Capital Projects Department's representative IMMEDIATELY. Contractor shall not proceed with work in area of any leaks until directed by the Capital Projects Department's representative. Gas line leaks at project completion shall be the responsibility of the Contractor and be repaired by a qualified, Licensed Contractor at no cost to the Owner. Contractor shall assume that all exposed conduit that exists within the work area is fully functional and operational for all wiring that is within the conduit at the start of the project. If at any time during construction, operations utilizing this wiring fail or are disrupted, the Contractor shall be responsible for repairs to make the operations fully functional by a qualified, Licensed Contractor at no cost to the Owner.

18. MATERIAL DISTURBANCE PERMIT

The Building Material Disturbance Permit (MDP) is a Washoe County School District (WCSD) document that identifies asbestos and lead site specific information, and it is issued by the Environmental, Safety & Assessment (ES&A) Department. A site-specific Material Disturbance Permit is required for each project. Each project and facility require a separate Material Disturbance Permit because each facility has specific information and direction regarding asbestos and lead, as each facility is different in that regard. The Material Disturbance Permit is to be requested by the Project Manager, or appointed District representative, in accordance with current Material Disturbance Permit requirements. No work can be done by a Contractor in WCSD without an MDP.

19. WATER SYSTEM DISTURBANCE

Improper closing of valves and other improperly conducted disruptions to District facilities can result in cross connections and back siphoning of chemicals and other contaminates into the water supply. Since these disturbances are very important, the District has added a water system disturbance section to the Material Disturbance Permit (MDP). Work, as a part of this contract, may involve the disturbance of a facilities water distribution system and, as such, the contractor is required to comply with the Water System Disturbance Permit Appendix section of

the Material, Water & Lead Disturbance Permit for any work impacting a facility water system.

The contractor shall carefully comply with all requirements of the Material, Water & Lead Disturbance Permit, and shall be aware of this process prior to bid preparation and any construction. The permit requirements are hereby made a part of this specification and contract to the same extent as if bound herein and shall apply to all contractors and subcontractors.

The contractor shall be responsible for all costs incurred by the Washoe County School District, including the consultant, sampling and testing, clean-up, replacement of effected equipment, materials, etc., and any legal action that may result from an unauthorized disturbance of a water system caused by the contractor or his subcontractors, resulting in a cross connection or backflow incident.

If Contractors have any questions regarding the requirements of the Water System Disturbance Permit, please call the ES&A Department for the Regulated Systems Compliance & Safety Officers at (775) 325-8491.

20. ASBESTOS

The Washoe County School District has approx. 60% of our facilities that contain asbestos-containing materials. Contractors performing disturbances to asbestos-containing materials must be properly licensed and trained per the EPA AHERA regulation, as well as other Federal, State, and Local regulations.

Since so many of the facilities contain asbestos, minor construction activities many times will involve disturbance of materials which contain asbestos. These projects may involve “small scale-short duration” asbestos disturbances also termed “Attachments & Penetrations” to non-friable materials. As a part of this contract, the successful contractor will be required to include Attachments & Penetrations into the scope of their work.

a. Asbestos and the Material Disturbance Permit

The Contractor shall carefully comply with all the items of the Building Material Disturbance Permit (MDP) and shall review the permit and become familiar with its contents prior to bid preparation and any construction.

Once a Material Disturbance Permit Request is received for a specific project, building materials that have been identified as being disturbed during construction, and/or demolition, will have been tested for the presence of asbestos. These materials will be identified as asbestos-containing or non-asbestos-containing on the building Material Disturbance Permit(s) by the District’s AHERA Management Planner. The Material Disturbance Permit must be referred to before any work commences. No outside asbestos sampling of building materials, by the Contractor or a Contractor hired asbestos consultant, is allowed.

All asbestos-containing material must be handled by contractors and/or individuals trained and certified in the removal of asbestos-containing building materials. No asbestos-containing materials shall be disturbed prior to authorization from the owner. If any material is encountered that is not listed on the Material Disturbance Permit, it shall immediately be brought to the attention of the Project Manager before any work continues that might disturb this material. If any building material listed in the disturbance permit as containing asbestos is improperly disturbed, in the opinion of the District, by the Contractor or his sub-contractor/s, the District will immediately hire a third-party asbestos consultant to investigate possible asbestos contamination, and an asbestos Contractor to perform any recommended clean-up.

The Contractor shall be responsible for all costs incurred by the District including the consultant, sampling and testing, clean-up, replacement of affected equipment, materials, etc., and any legal action that may result from an asbestos fiber release incident caused by the Contractor or his sub-contractors.

b. Asbestos Abatement (The removal of an asbestos material)

Attachments and Penetrations does not include the removal (other than drilling holes) of asbestos containing materials. Any removal of asbestos-containing materials is not an “Attachment and Penetration” activity, but rather an abatement, and any abatement of asbestos materials must be designed by an EPA AHERA certified Asbestos Project Designer. Any abatement project’s design will be the responsibility of the District to design and provide abatement specifications. Asbestos abatement (Removal) must be conducted by an asbestos abatement contractor, which will be supervised by the District and/or a District hired asbestos abatement consultant. The abatement costs will be included into the scope of this project.

c. Asbestos – Attachments & Penetrations

Attachments & Penetrations, for the purpose of this document, is the drilling of holes, installing/removing screws, installing anchors, nails, and staples in non-friable asbestos-containing materials, in which the disturbance may release asbestos fibers. Attachments & Penetrations are minor disturbances that are normal activities such as installing conduits, mounting boxes or brackets, and removing equipment anchors from asbestos containing materials. The Material Disturbance Permit will identify which materials at a specific site can be disturbed, and the minimum requirements to perform an asbestos disturbance.

d. “Small Scale-Short Duration” – WCSD Attachment & Penetration Procedures

The WCSD Attachment & Penetration Procedures that the Contractor must utilize, when identified as being required in the MDP, are available from the Project Manager. The contractor shall submit their WCSD Attachment &

Penetration Procedures to the Project Manager. The Project Manager will submit the documents to the ES&A Department for approval.

The contractor can add additional requirements, but nothing required in the MDP and WCSD Attachment & Penetration Procedures may be omitted. The Contractor must submit their Attachment & Penetration Procedure to their Project Manager to get ES&A approval of these documents **prior to any disturbance.** The ES&A Department will notify the contractor upon approval of these documents.

Once the approval of the WCSD Attachment & Penetration Procedure and training certificates is received, the contractor may schedule the disturbance, but must notify the ES&A Department immediately prior to disturbing the asbestos-containing materials. The Contractor shall provide this notice by calling the ES&A Attachment & Penetration hotline at 325-8490, follow the directions, and leave a message. ES&A Department personnel, Project Managers, Assistant Project Managers/PCI's, and other district personnel may conduct site visits to ensure compliance with the contractor's submitted and approved procedures.

e. Asbestos Training Certificates – Abatement

Abatement of asbestos-containing materials, as allowed and identified in the Material Disturbance Permit, will be done by an Asbestos Abatement Contractor, with workers that have a minimum of 32-hour AHERA asbestos training (Asbestos Worker), and supervised by an abatement supervisor with 40-hour AHERA asbestos training (Contactor/Supervisor). Workers and supervisors must also get an annual refresher certificate if the original training is greater than one year old. Contractor training certificates will be submitted to the Project Manager at least two weeks prior to the start of the project. The ES&A Department will review the submitted training documentation, verify certificates as required, and approve the abatement workers and supervisors, so they can work on the assigned WCSD project. No one that has not been approved by the ES&A Department is authorized to perform any asbestos disturbances within the WCSD.

New workers added after the start of the project will be approved by the ES&A Department within one 8-hour work period of the standard Monday thru Friday work schedule. Certification submittal will be serviced by the ES&A Department on a first come, first served basis. Delays to review the documentation will be anticipated and taken into account on any abatement schedule developed, and asbestos workers and supervisors will not be allowed to work in any way on that project until their documentation has been reviewed and approved.

f. Asbestos Training Certificates – Attachment & Penetration

Contractors performing "Attachment & Penetration" work on non-friable asbestos-containing materials, as allowed, and identified in the Material Disturbance Permit, will be required to have a minimum of 16 hours of

AHERA asbestos training (Operations & Maintenance, or O&M), as well as an annual refresher certificate if the original training is greater than one year old. Contractor training certificates will be submitted to the Project Manager at least two weeks prior to the start of the project. The ES&A Department will review the submitted training documentation, verify certificates as required, and approve the Attachment & Penetration technicians, so they can work on the assigned WCSD project. No one that has not been approved by the ES&A Department is authorized to perform any asbestos disturbances within the WCSD.

New workers added after the start of the project will be approved by the ES&A Department within one 8-hour work period of the standard Monday thru Friday work schedule. Certification submittal will be serviced by the ES&A Department on a first come, first served basis. Delays to review the documentation will be anticipated and taken into account on any Attachment & Penetration schedule developed, and Attachment & Penetration technicians will not be allowed to work in any way on that project until their documentation has been reviewed and approved.

g. Asbestos Air Sampling, Respiratory Protection, and Protective Suits

Asbestos personal air sampling is required during any asbestos disturbance. Asbestos air sampling results will be supplied to the ES&A Department, and the Project Manager, within 48 hours of the completion of a disturbance. Laboratory results will be emailed directly to the ES&A Department from the laboratory providing analysis. Handwritten results will not be allowed. Regardless of air sampling results, Contractors will not be allowed to submit a Negative Exposure Assessment so that they can discontinue the use of respirators and personal protective suits. The District reserves the right to require this requirement, to reduce the long-term exposure liability from Contractors and their workers, which have disturbed this owner's asbestos materials.

If training certificates are issued for a class, those training certificates need to be submitted. Wallet cards will not be accepted as a training certificate unless no training certificate is provided by the training provider. In order for a wallet card to be accepted, the contractor will supply a letter from the training provider stating that no training certificate was provided, and only wallet cards were supplied to attendees. Wallet cards are less desirable due to their small size and mitigate the ability to clearly read and verify all the information on the card. Contractors are encouraged to request a full size 8 ½" x 11" training certificate from their training providers.

21. <u>LEAD PAINTS, COATINGS, CERAMIC TILE, AND LEAD-CONTAINING MATERIALS IN WCSD FACILITIES</u>

a. Lead-containing paints, coatings, ceramic tile, and lead materials are present in WCSD facilities.

Bidders/Contractors that disturb lead-containing or potentially lead-

containing paints, coatings, ceramic tile, and lead-containing materials, by law, are required to know all applicable regulations, and comply with all state and federal regulations that apply to the disturbances to lead-containing paints, coatings, ceramic tile, and lead-containing materials they are conducting. The regulations that are recommended by the District for a contractor to be properly trained and knowledgeable related to lead disturbances, includes, but is not limited to, the following:

OSHA Regulation CFR 1926.62 – Lead & Appendix A, B, C, & D – Lead Construction Standard.
OSHA Regulation CFR 1910. 1025 - Lead & Appendix A, B, C, & D – General Industry Standard.
EPA, 40 CFR Part 745 – Lead; Renovation, Repair, and Painting Regulation.

b. Lead and the Material Disturbance Permit

The Contractor shall carefully comply with all items of the Building Material Disturbance Permit (MDP) and shall review the permit and become familiar with its contents prior to bid preparation and any construction.

Once a Material Disturbance Permit request is received for a specific project, building materials that have been identified as being disturbed during construction, and/or demolition, will have been tested for the presence of lead. These materials will be identified as lead-containing or not lead-containing on the building Material Disturbance Permit(s) by the District's ES&A Staff. The Material Disturbance Permit must be referred to before any work commences. **No outside lead sampling of building materials, by the Contractor or a Contractor hired lead consultant, is allowed.**

All lead-containing materials must be handled by contractors and/or individuals trained and certified to perform lead disturbances. No lead-containing materials shall be disturbed prior to authorization from the owner. If any building material listed in the disturbance permit as lead-containing are improperly disturbed, in the opinion of the District, by the Contractor or his sub-contractor, the District will immediately hire a third-party lead consultant to investigate possible lead contamination, and a lead removal Contractor to perform any recommended clean-up.

The Contractor shall be responsible for all costs incurred by the District, including the consultant, sampling and testing, clean-up, replacement of the affected equipment, materials, etc., and any legal action that may result from a lead contamination incident caused by the Contractor or his sub-contractors.

Bidders/Contractors accept and acknowledge, by signing the Material Disturbance Permit, the existence of lead related regulations, and accept all liability related to the disturbance of lead-containing materials, citations resulting from, or any other costs the District may incur by the action of all parties of the bidders' company or companies hired by the successful bidder

to complete this project.

c. Construction Age of Buildings in the District

At the conception of adding lead information to MDP's, it was thought that lead-containing paints, coatings, and ceramic tile were much more likely to be present on more surfaces in the District's older facilities. However, recent sampling has shown lead containing paints, coatings and ceramic tiles DO routinely exist, even in our newest facilities. Due to that finding, the age of buildings is not as important as was originally thought. We are still providing construction date information in MDP's because lead-based paint >5000 ppm is much less likely in facilities built after 1978.

d. Pre – 1978 WCSD Buildings

Paint and coating sampling have shown that paints and coatings contain some levels of lead in the Districts' Pre-1978 facilities. Therefore, all persons performing **any** disturbance to coatings or paints in our Pre-1978 constructed facilities must utilize lead safe work practices. In addition, any person performing **any** disturbance to paints, coatings, ceramic tile, and lead-containing materials must have taken an OSHA lead action level training class from a WCSD ES&A Department approved training provider. If identified as lead-containing, the Contractor will be required to perform all disturbances as per the MDP, WCSD provided lead specification, and all local, state, and federal regulations.

e. Post – 1978 WCSD Buildings

While it was originally thought that paints and coatings on materials other than metal surfaces and ceramic tile typically did not contain lead in WCSD post – 1978 constructed facilities, sampling has shown that is not the case. The MDP will provide specific historical sampling that has been conducted in the District facilities. If past sampling has shown the presence of lead-containing paints and coatings in the facility, the Contractor will be required to treat all painted and coated surfaces as lead-containing. If identified as lead-containing, the Contractor will be required to perform all disturbances as per the MDP, WCSD provided lead specification, and all local, state, and federal regulations.

The MDP will state all buildings identified above were constructed after 1978. While it was originally thought that paints, coatings and ceramic wall tile are less likely to contain lead in newer WCSD facilities, recent sampling has shown lead-containing paints, coatings, and ceramic tiles DO routinely exist, even in our newest facilities. Due to that finding, Contractors must treat all paints, coatings, and ceramic tile as lead-containing unless WCSD project sampling has proven otherwise, and it will be deemed negative within the MDP and the project scope. **The Bidder/Contractor must comply with all lead-containing or assumed lead-containing paint and coating disturbance instructions and requirements listed in the MDP, District provided lead specifications, and all local, state, and federal**

regulations, unless the material has been proven, to the satisfaction of the District, that said materials do not contain lead.

f. Lead Removal (The removal of a lead-containing material)

Attachments and Penetrations does not include any removal, demo, welding, sanding, abrading, sandblasting, cutting, grinding, heating, and torch cutting of lead-containing materials, and is not an "Attachment and Penetration" disturbance. These activities must be designed by an EPA Certified Lead Consultant. The project's design for the above-listed activities will be the responsibility of the District to design and provide the specs as a part of this bid package. Lead activities listed above must be conducted by a lead removal contractor, which will be supervised by the District and/or District hired EPA Certified Lead Consultant. The lead activities costs will be included into the scope of each project.

g. Lead Attachments & Penetrations

Attachments & penetrations, for the purpose of this document, is the drilling of holes, installing/removing screws, installing anchors, nails, and staples, in which the disturbance may release lead dust. Attachments and Penetrations are minor disturbances that are normal activities such as installing conduits, mounting boxes or brackets, and removing equipment anchors from lead-containing materials. The Material Disturbance Permit will identify which materials at a specific site can be disturbed, and the minimum requirements to perform a lead disturbance.

h. Lead Safe Work Practices – WCSD Attachment & Penetration Procedures

The WCSD Attachment & Penetration Procedures that the Contractor must utilize, when identified as being required in the MDP, are available from the Project Manager. The contractor shall submit their WCSD Attachment & Penetration Procedures to the Project Manager. The Project Manager will submit the documents to the ES&A Department for approval.

The contractor can add additional requirements, but nothing required in the MDP and WCSD Attachment & Penetration Procedures may be omitted. The Contractor must submit their Attachment & Penetration Procedure to their Project Manager to get ES&A approval of these documents **prior to any disturbance.** The ES&A Department will notify the contractor upon approval of these documents.

Once the approval of the WCSD Attachment & Penetration Procedure and training certificates is received, the contractor may schedule the disturbance, but must notify the ES&A Department immediately prior to disturbing the lead-containing materials. The Contractor shall provide this notice by calling the ES&A Attachment & Penetration hotline at 325-8490, follow the directions, and leave a message. ES&A Department personnel, Project Managers, Assistant Project Managers/PCI's, and other district personnel may conduct site visits to ensure compliance with the contractor's

submitted and approved procedures.

i. Lead Training Certificates – Removal and Attachments & Penetrations

The health and safety of all occupants of the WCSD facilities is the number one priority of the District. To that end, technicians performing disturbances to lead-containing materials must have adequate training. Contractors performing lead disturbances, as allowed and identified in the Material Disturbance Permit, will be required to have a minimum of "OSHA Lead Action Level" training, as well as an annual OSHA Lead Action Level training certificate if the original training is greater than one year old, before being approved to perform lead disturbances. OSHA Lead Action Level training will be conducted in accordance with OSHA 1926.62(l)(2)(i) thru (viii) and all required topics identified in this standard will be completed to include:

- 1926.62(l)(2)(i) The content of this standard and its appendices;
- 1926.62(l)(2)(ii) The specific nature of the operations which could result in exposure to lead above the action level;
- 1926.62(l)(2)(iii) The purpose, proper selection, fitting, use, and limitations of respirators;
- 1926.62(l)(2)(iv) The purpose and a description of the medical surveillance program, and the medical removal protection program including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant);
- 1926.62(l)(2)(v) The engineering controls and work practices associated with the employee's job assignment including training of employees to follow relevant good work practices described in Appendix B of this section;
- 1926.62(l)(2)(vi) The contents of any compliance plan in effect;
- 1926.62(l)(2)(vii) Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician; and
- 1926.62(l)(2)(viii) The employee's right of access to records under 29 CFR 1910.20.

Certificates of Training showing that technicians have successfully completed an OSHA Lead Action Level course and are required to be properly submitted and approved by the District's ES&A Department prior to any Contractor's technician performing any disturbances to lead-containing or assumed lead-containing paints or coatings, or any other lead-containing materials. The training certificate must have "OSHA Lead Action Level Training" clearly identified on the training certificate and should have a sentence that states that the training topics covered in the

class meet or exceed the training topics of OSHA 1926.62(I)(2)(i) thru (viii).

If training certificates are issued for a class, those training certificates need to be submitted. Wallet cards will not be accepted as training certificates unless no training certificate is provided by the training provider. In order for a wallet card to be accepted, the contractor will supply a letter from the training provider stating that no training certificate was provided, and only wallet cards were supplied to attendees. Wallet cards are less desirable due to their small size and mitigate the ability to clearly read and verify all the information on the card. Contractors are encouraged to request a full size 8 ½" x 11" training certificate from their training providers.
It is important that Contractor's planning on doing the lead work within the District become familiar with the lead training requirements, and spend the time confirming that the lead classes being taken are truly an OSHA Lead Action Level course, and not a lead awareness course as identified above. Many training providers have differing training class titles on their lead classes, but only training certificates that are noted as above will be accepted to fulfill the listed District's training requirements. Contractors requiring training are responsible in providing the training providers a clear understanding of what training is required.

Full Lead worker initial and annual training certificates that comply with adjacent state requirements for lead worker certification, will be accepted in lieu of the OSHA Lead Action Level training certificate, as long as they are titled "Lead Worker" and then accompanied with a letter from the training provider certifying that the topics identified in OSHA 1926.62(I)(2)(i) thru (viii) were covered in that class. Contractors are responsible with ensuring and verifying training certificates meet the above-listed requirements. Training certificates that do not have "OSHA Lead Action Level or Lead Worker" will not be accepted or submitted.

Contractor training certificates will be submitted to the Project Manager at least two weeks prior to the start of the project. The ES&A Department will review the submitted training documentation and must pre-approve workers so they can work on the assigned WCSD project. No one that has not been approved by the ES&A Department is authorized to perform any lead disturbances.

New workers added after the start of the project will be approved by the ES&A Department within one 8-hour work period of the standard Monday thru Friday work schedule. Certification submittal will be serviced by the ES&A Department on a first come, first served basis. Delays to review the documentation will be anticipated and taken into account on any Removal or Attachment & Penetration schedule developed, and Removal and/or Attachment & Penetration technicians will not be allowed to work in any way on that project until their documentation has been reviewed and approved.

j. Renovation, Repair & Painting Regulations (RR&P) - 40 CFR Part 745.81

Effective April 22, 2010, contractors will be required to be trained and registered with the EPA to conduct regulation applicable renovations, repairs and painting (RR&P) in all **elementary schools or child occupied District facilities constructed prior to 1978 when lead-based paints and coatings are being disturbed**. Contractors are reminded that there are some childcare facilities in middle and high school locations, and the RR&P would apply at those locations as outlined in the RR&P regulation requirements. http://www.epa.gov/lead/pubs/steps.pdf

In general, all firms that disturb 6 square feet of **lead-based** painted surface per room on the interior, or 20 square feet on the exterior, within a 30 day period in **this** facility, must comply with the EPA's Renovation, Repair and Painting (RR&P) regulation **and** must be registered with the federal EPA. Per the Regulation, the area of disturbance is calculated by adding up the entire surface areas being removed/disturbed, which then determines the amount of painted surface area disturbed. Work that involves window replacement or demolition of a painted surface, the EPA RR&P regulation applies regardless of size if lead-based paint is present.

The District requires all workers in RR&P projects involving lead disturbances to have, at a minimum, OSHA lead action level training. This regulation also requires that the contractor must assign an EPA RR&P certified renovator that is responsible for ensuring and documenting all work is conducted in compliance with the EPA RR&P regulation. There are extensive record keeping and notification requirements that the Contractor must perform. All workers with the minimum OSHA lead action level training, but are not EPA RR&P certified renovator trained, must be trained and supervised by the EPA RR&P certified renovator.

On a RR&P project, Contractors must have a minimum of one EPA RR&P certified renovator on-site that has successfully attended and passed a 8-hour EPA accredited renovator training course before working in any elementary schools or child occupied District facilities constructed prior to 1978. The renovator's training certification must remain current. Recertification requirements through the attendance of refresher courses are a requirement of this regulation. The renovator must be on-site throughout the project. The certified renovator is responsible for ensuring that lead safe work practices are utilized per this EPA RR&P regulation, as well as per all District lead requirements and policies that may be more stringent than the EPA and OSHA regulations.

The EPA RR&P regulation requires that personnel disturbing lead containing materials utilize lead safe work practices as identified in the EPA guidance document titled **"steps to lead safe renovation, repair and painting", pages 12 through 23**. This document is available electronically at http://www.epa.gov/lead/pubs/steps.pdf. The contractor shall submit lead safe work practice procedures, and all RR&P and OSHA lead action level training certificates to the Project Manager at least two weeks prior to the

start of the project. The ES&A Department will review the submitted training documentation and must pre-approve workers so they can work on the assigned WCSD project. No one that has not been approved by the ES&A Department is authorized to perform any lead disturbances.

New workers added after the start of the project will be approved by the ES&A Department within one 8-hour work period of the standard Monday thru Friday work schedule. Certification submittal will be serviced by the ES&A Department on a first come, first served basis. Delays to review the documentation will be anticipated and taken into account on any RR&P project schedule developed, and EPA RR&P certified renovators and workers will not be allowed to work in any way on that project until their documentation has been reviewed and approved.

This is a general overview of the regulation and the contractor must refer to the regulation for additional requirements and information. Fines are expensive and are levied toward the Contractor not the owner, so compliance with this regulation is very important, and it is important that Bidders/Contractors are well versed in this regulation.

k. Lead Air Sampling, Respiratory Protection and Protective Suits

Lead personal air sampling is required during any lead disturbance. Lead air sampling results will be supplied to the ES&A Department, and the Project Manager, within 48 hours of the completion of a disturbance. Laboratory results will be emailed directly to the ES&A Department from the laboratory providing analysis. Handwritten results will not be allowed. Regardless of air sampling results, Contractors will not be allowed to submit a Negative Exposure Assessment so that they can discontinue the use of respirators and personal protective suits. The District reserves the right to require this requirement, to reduce the long-term exposure liability from Contractors and their workers, which have disturbed this owner's lead materials.

22. INDOOR ENVIRONMENTAL QUALITY

Preventative job site practices will reduce the potential for residual problems with indoor air quality in completed buildings and reduce undue health risks for all workers. The following are the minimum standards required by the WCSD for on-site construction in the district.

a. Existing HVAC System:
When feasible, the HVAC system for the project area will be shut down for the duration of the project. If occupied spaces will be adversely affected by the shut-down of the system, construction area return registers should be sealed with polyethylene sheeting and secured as an alternative. Registers must be sealed prior to the start of work.

b. Separating Occupied Spaces From Non-Occupied:
Keep work areas separate from occupied spaces with polyethylene sheeting

(or similar) if there are no other natural barriers in place OR in spaces where air exchange will occur around the barriers.

c. Ventilation:
During the installation of carpet, paints, furnishings and any other VOC emitting products, provide “spot” ventilation during application/installation and for at least 24 hours after the work is completed. In most cases, opening windows and doors will not be enough to effectively exhaust contaminants. It is recommended that an exhaust fan be used to pull polluted air out of the building. This can be accomplished by placing a fan in a window or door and temporarily sealing any opening around the fan with plastic. Additionally, a door or window at the opposite end of the room should be opened to allow fresh, outdoor air to flow across the work area and sweep polluted air out through the exhaust fan. As long as odors are present, the temporary exhaust ventilation must continue to operate. This may include nights and weekends, as necessary. Ventilation should continue for a minimum of 24 hours after the completion of the project or until there are no more noticeable odors.

d. Construction Dust:
Minimize the amount of dust in the air and on surfaces. Examples include the use of vacuum assisted drywall sanding equipment and the use of vacuums instead of brooms to clean construction dust from floors.

e. After Hours Scheduling:
Schedule high dust generating operations or extreme noise generating activities for after normal working hours. (i.e. saw cutting, jack hammering) and install temporary barriers to confine dust, as necessary.

f. Gasoline/Diesel Powered Equipment:
Electric powered equipment must be used in lieu of diesel or gasoline powered equipment. Gas and diesel equipment may not be used inside a WCSD building or near an outdoor fresh air building intake.

g. Material Safety Data Sheets (MSDS):
MSDS must be made be maintained onsite and made available upon request as required by federal law.

h. Construction Completion:
Prior to the occupancy of the building but after the installation of new furniture, carpet, etc., the building should be flushed with 100% outside air for one to three days.

i. Air Filters:
Replace all filtration media immediately at the conclusion of the job.

j. Monitoring Air Quality:
Indoor air quality monitoring will be conducted randomly throughout the project. Results and any recommendations will be communicated through the building inspector to construction management.

k. Pre-Construction Work Area Inspection:
Any overhead work including roof, the Contractor shall conduct a pre room condition walk through with WCSD Project Manager to determine the level of cleanliness that will be expected at completion of project. Contractor shall be responsible for cleaning all exposed surfaces within the facility beneath the work area. At the completion of the project, the Contractor shall clean all exposed surfaces within the facility beneath the aforementioned work area including but not limited to all shelving, duct, lighting, flooring, furniture, etc.

23. LOCK OUT TAG OUT (LOTO) PROCEDURE

Contractor will be responsible for the isolation and termination of all building systems that may be impacted by the scope of work within this bid. Contractor will coordinate all shut-down processes with the construction manager prior to any shutdowns up to and including Lock Out Tag Out procedures 24 hours prior to any shutdowns. WCSD will make the final determination of which systems and location shall be isolated. All Lock Out Tag Out will be performed at main service panel.

SECTION 00830 - TECHNICAL SPECIFICATIONS

I. SUMMARY OF THE WORK:

The work shall include the furnishing of all labor, tools, equipment, material, transportation and the performance of all operations required for the **Mini-Modernization at Libby Booth Elementary School** at the site(s) and associated work as specified herein and shall include the cleanup and removal from the site(s) of all debris resulting from the operations performed. It shall also be the Contractor's responsibility to take all necessary safety precautions and to furnish barricades and/or other safety measures as required.

All work shall be performed in strict accordance with the requirements of these specifications and any and all appropriate state, county and local ordinances.

II. LOCATION OF THE WORK:

The location(s) of the work and contact person(s) are:

Libby Booth Elementary School
1450 Stewart St.
Reno, NV 89502
Phone #: 775 333-5140
Principal: Mary Culpepper
Site Facilities Coordinator: Oscar De-Leon Carpio

The Contractor is urged to examine the site(s) and compare the existing conditions with that of the work outlined. No extra payment will be considered for work additional to that shown or noted if such work would have been apparent in an inspection of the premises.

To review the existing premises, contact the Principal and/or Site Facilities Coordinator at the site(s). **Whenever at the site, be sure to check in at the front office**.

At the above-named site(s), school classes and other construction projects may or may not be taking place during the construction phase. It will require coordination between the school site(s), other vendors, and the WCSD's Capital Projects Department.

III. QUESTIONS & CLARIFICATIONS:

For questions and clarifications regarding the Technical Specifications, Drawings, General Conditions, Special Conditions, Bidding and Contract Information contact the Purchasing Department at solicitations@washoeschools.net.

This project will have two (2) question deadlines:

- Initial questions shall be submitted by **4:30 p.m. (Local Time) on October 21, 2026**, and an addendum will be issued with

responses.

- All FINAL questions shall be submitted by **4:30 p.m. (Local Time) on November 3, 2026,** and a FINAL addendum will be issued with responses.

All questions shall be submitted in writing directly to WCSD's Solicitations website at http://solicitations.washoeschools.net/ or via e-mail to solicitations@washoeschools.net.

IV. MANUFACTURERS:

Manufacturers, types, model numbers and execution as detailed on the drawings.

V. ASBESTOS ASSESSMENT:

The Material, Water & Lead Disturbance Permit(s) are included in the Special Conditions section of the Specifications.

2026-2027 Balanced Calendar

July 2026							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 0
			1	2	3	4	
5	6	7	8	9	10	11	
12	13	14	15	16	17	18	
19	20	21	22	23	24	25	
26	27	28	29	30	31		

August 2026							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 16
						1	
2	3	4	5	6	7	8	August 4 - 6 - Teacher Professional Dev. Day
9	10	11	12	13	14	15	August 7 - Teacher Work Day
16	17	18	19	20	21	22	August 10 - First Day of School for Students
23	24	25	26	27	28	29	August 10 - 14 - Kindergarten Testing Week
30	31						August 17 - First Day for Kindergarten and Pre Kindergarten Students

September 2026							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 21
		1	2	3	4	5	
6	7	8	9	10	11	12	September 7 - Labor Day
13	14	15	16	17	18	19	
20	21	22	23	24	25	26	
27	28	29	30				

October 2026							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 16
				1	2	3	October 5 - 9 - Fall Break
4	5	6	7	8	9	10	October 12 - Teacher Professional Dev. Day
11	12*	13	14	15	16	17	October 16 - End of Grading Period
18	19	20	21	22	23	24	October 23, 26-29 - Conference Week
25	26	27	28	29	30	31	October 30 - Nevada Day

November 2026							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 17
1	2	3	4	5	6	7	
8	9	10	11	12	13	14	November 11 - Veterans Day
15	16	17	18	19	20	21	
22	23	24	25	26	27	28	November 25 - 27 - Thanksgiving Break
29	30						

December 2026							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 13
		1	2	3	4	5	
6	7	8	9	10	11	12	December 17 - End of Grading Period
13	14	15	16	17	18	19	December 18 - Teacher Work Day
20	21	22	23	24	25	26	December 21 - January 1 - Winter Break
27	28	29	30	31			

January 2027							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 19
					1	2	December 21 - January 1 - Winter Break
3	4*	5	6	7	8	9	January 4 - Teacher Professional Dev. Day
10	11	12	13	14	15	16	
17	18	19	20	21	22	23	January 18 - Martin Luther King, Jr. Day
24	25	26	27	28	29	30	
31							

February 2027							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 19
	1	2	3	4	5	6	
7	8	9	10	11	12	13	
14	15	16	17	18	19	20	February 15 - President's Day
21	22	23	24	25	26	27	February 23 - College and Career Readiness Assessment for high schools only.
28							

March 2027							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 15
	1	2	3	4	5	6	
7	8	9	10	11	12	13	
14	15	16	17	18	19	20	March 12 - End of Grading Period
21	22	23	24	25	26	27	March 22 April 2 - Spring Break
28	29	30	31				

April 2027							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 20
				1	2	3	March 22 April 2 - Spring Break
4	5	6	7	8	9	10	
11	12	13	14	15	16	17	
18	19	20	21	22	23	24	
25	26	27	28	29	30		

May 2027							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 20
						1	
2	3	4	5	6	7	8	
9	10	11	12	13	14	15	
16	17	18	19	20	21	22	
23	24	25	26	27	28	29	
30	31						May 31 - Memorial Day

June 2027							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 4
		1	2	3	4	5	
6	7	8	9	10	11	12	June 4 - End of Grading Period
13	14	15	16	17	18	19	June 4 - Last Day of School
20	21	22	23	24	25	26	June 7, 8, 9 - Contingency Days
27	28	29	30				June 19 - Juneteenth

	Number of Days per Quarter	44	39	48	49	180
October 12, 2026 & January 4, 2027 are non-student days used for professional development but counted as school days in session per NAC 387.140	Number of Days per Semester	83		97		180
	Contingency Days: June 7, 8, 9					

Teacher Work Days: August 4 - 7, 2026 & December 18, 2026

Teacher Professional Dev. Days: October 12, 2026 & January 4, 2027

2027-2028 Balanced Calendar

July 2027							Number of School Days
S	M	T	W	TH	F	S	0
				1	2	3	
4	5	6	7	8	9	10	
11	12	13	14	15	16	17	
18	19	20	21	22	23	24	
25	26	27	28	29	30	31	

August 2027							Number of School Days
S	M	T	W	TH	F	S	17
1	2	3	4	5	6	7	August 3 - 5 - Teacher Professional Dev.
8	9	10	11	12	13	14	August 6 - Teacher Work Day
15	16	17	18	19	20	21	August 9 - First Day of School
22	23	24	25	26	27	28	
29	30	31					

September 2027							Number of School Days
S	M	T	W	TH	F	S	21
			1	2	3	4	
5	6	7	8	9	10	11	September 6 - Labor Day
12	13	14	15	16	17	18	
19	20	21	22	23	24	25	
26	27	28	29	30			

October 2027							Number of School Days
S	M	T	W	TH	F	S	15
					1	2	
3	4	5	6	7	8	9	October 4 - 8 - Fall Break
10	11*	12	13	14	15	16	October 11 - Teacher Professional Dev.
17	18	19	20	21	22	23	October 15 - End of Grading Period
24	25	26	27	28	29	30	October 18 - 22 Conference Week
31							October 29 - Nevada Day

November 2027							Number of School Days
S	M	T	W	TH	F	S	18
	1	2	3	4	5	6	
7	8	9	10	11	12	13	November 11 - Veterans Day
14	15	16	17	18	19	20	
21	22	23	24	25	26	27	November 24 - 26 - Thanksgiving Break
28	29	30					

December 2027							Number of School Days
S	M	T	W	TH	F	S	12
			1	2	3	4	December 16 - End of Grading Period
5	6	7	8	9	10	11	December 17 - Teacher Work Day
12	13	14	15	16	17	18	December 17 - 31 - Winter Break
19	20	21	22	23	24	25	
26	27	28	29	30	31		

January 2028							Number of School Days
S	M	T	W	TH	F	S	20
						1	
2	3*	4	5	6	7	8	January 3 - Teacher Professional Dev.
9	10	11	12	13	14	15	
16	17	18	19	20	21	22	January 17 - Martin Luther King Jr. Day
23	24	25	26	27	28	29	
30	31						

February 2028							Number of School Days
S	M	T	W	TH	F	S	20
		1*	2	3	4	5	February 1 - Teacher Professional Dev.
6	7	8	9	10	11	12	
13	14	15	16	17	18	19	
20	21	22	23	24	25	26	February 21 - President's Day
27	28	29					February 29 - College and Career Readiness Assessment for high schools only.

March 2028							Number of School Days
S	M	T	W	TH	F	S	13
			1	2	3	4	
5	6	7	8	9	10	11	March 10 - End of Grading Period
12	13	14	15	16	17	18	
19	20	21	22	23	24	25	March 20 - 31 - Spring Break
26	27	28	29	30	31		

April 2028							Number of School Days
S	M	T	W	TH	F	S	20
						1	
2	3	4	5	6	7	8	
9	10	11	12	13	14	15	
16	17	18	19	20	21	22	
23	24	25	26	27	28	29	
30							

May 2028							Number of School Days
S	M	T	W	TH	F	S	22
	1	2	3	4	5	6	
7	8	9	10	11	12	13	
14	15	16	17	18	19	20	
21	22	23	24	25	26	27	May 29 - Memorial Day
28	29	30	31				May 31 - Contingency Day in Session

June 2028							Number of School Days
S	M	T	W	TH	F	S	2
				1	2	3	June 2 - End of Grading Period
4	5	6	7	8	9	10	June 2 - Last Day of School
11	12	13	14	15	16	17	June 1 - 2 - Contingency Day in Session
18	19	20	21	22	23	24	June 19 - Juneteenth
25	26	27	28	29	30		

October 11, 2027 & January 3, 2028 & February 1, 2028 are non-student days used for professional development but counted as school days in session per

Number of Days Per Quarter	44	39	48	49	180
Number of Days Per Semester	83		97		180

Teacher Work Days: August 3-6, 2027 & December 17, 2027

Teacher Professional Dev. Days October 11, 2027, January 3, 2028 & February 1, 2028

BID FORM

Washoe County School District - Purchasing Department
14101 Old Virginia Road - Reno, Nevada 89521
Phone: 775-850-8025 Email: solicitations@washoeschools.net

Bid #27-17-B-09-BC
PWP # WA-2027-035

Having carefully examined all of the Bid Specifications entitled **Mini-Modernization at Libby Booth Elementary School,** dated September 25, 2026; and the Drawings dated August 28, 2026; the addenda numbered _____; as well as the premises and the conditions affecting the work, the undersigned proposes to furnish for the stipulated sum of:

ITEM	DESCRIPTION	AMOUNT
A.	BASE BID 1	$
B.	FORCE ACCOUNT	$500,000.00
C.	**TOTAL – BASE BID 1 AND FORCE ACCOUNT (The Sum of Box A + Box B)**: All labor and materials for the **MINI-MODERNIZATION AT LIBBY BOOTH ELEMENTARY SCHOOL** as drawn and specified, the sum of _____ _____Dollars ($_____).	

Additive Alternate 1: Repaint Exterior of two (2) Portables as drawn and specified, the sum of

_____Dollars ($_____).

If there is a mathematical error between the Base Bid amount and the Force Account amount and the total of those two items added together, WCSD will make the correction which may revise the Total Amount.

Any bid submission will be disqualified and rejected if the bid submission is not signed.

Bids shall be submitted on the provided Bid Form (PUR-F523) only, and all of the blank spaces shall be completed; numbers shall be stated both in writing and in figures, the signature shall be in longhand; and the completed form shall be without interlineation, alteration or erasure. Washoe County School District only accepts signatures done manually (also known as a wet signature) or electronic digital signatures that are certified. Non-certified electronic digital signatures will NOT be accepted. A typed signature, even in cursive font, DOES NOT meet the requirements of an official digital signature. A digital signature must be accompanied by a certified digital stamp issued through programs like Adobe Acrobat, Docu-Sign or other similar programs that produce a digital stamp certifying the electronic digital signature. Any signatures on required forms that do not meet these requirements will not be accepted and the Contractor's submission will be deemed "Non-Responsive" and will be rejected. If you have any questions about this requirement, please submit your question by the question deadline,

so that it can be answered prior to bid submission deadline. In the event of a discrepancy on the Bid Form, NRS 104.3114 Contradictory terms of instrument states that, "If an instrument contains contradictory terms, typewritten terms prevail over printed terms, handwritten terms prevail over both, and WORDS PREVAIL OVER NUMBERS." **WCSD will record the bid amount stated in WORDS in Box C**. Only bids on the form(s) provided will be accepted. No additional pages containing inclusions, exclusions or clarifications will be accepted as part of the bid. Any clarifications, additions or exclusions made by the Washoe County School District (WCSD/ OWNER) will be considered incorporated into the specifications.

Bidder shall proofread his/her bid carefully for errors.

WCSD reserves the right to award the bid for the best proposal for each individual item or to award on the best total proposal, whichever is deemed by the Owner to be in their best interests. WCSD also reserves the right to reject any or all bids and to waive irregularities or informalities in any bid for any reason whatsoever.

If they be notified of the acceptance of this proposal within forty-five (45) days of the time set for opening of bids, Contractor agrees to execute a contract for the above work for the above-stated compensation in the form of the contract attached within these bid specifications and to commence the physical work no fewer than ten (10) days after the execution thereof.

The undersigned agrees, if awarded the contract, work is to be commenced upon issuance of a Notice to Proceed and shall be completed on or before October 31, 2027. The commencement date for the physical work shall be coordinated by the Capital Projects Department upon the receipt of said Notice to Proceed. The undersigned further agrees that the Owner may retain from the monies due the Contractor Two Thousand Five Hundred Dollars ($2,500) per day as a direct result of the Contractor's delay for not completing the project in the required time allowance plus approved time extensions.

The undersigned agrees, if awarded the contract, to execute and deliver to the Owner, within ten (10) calendar days after delivery of notice of award of contract, an executed contract, satisfactory insurance, a performance bond for each awarded contract, and a labor & materials bond for each awarded contract in accordance with the specifications.

Enclosed is a bid bond or other surety in the amount of five percent (5%) of each total proposal (must be provided for each individual base bid item), as required in the Instructions to Bidders.

Enclosed, on the attached form, is a complete listing of the names of each subcontractor who will provide labor or a portion of the work or improvement to the prime contractor for which the subcontractor will be paid equal to or exceeding 5 percent of the prime contractor's total bid. The prime Contractor shall also add his/her name if they are performing any portion of work, including supervision, equal to or exceeding 5 percent of the total bid.

Within two (2) hours after the completion of the opening of the bids, the contractors who submitted the three lowest bids must submit on the form attached a list of each subcontractor who will provide labor or a portion of the work or improvement to the prime contractor for which they will be paid an amount equal to or exceeding 1 percent of the prime contractor's total bid or $50,000, whichever is greater, and the number of the license issued to the subcontractor pursuant to chapter 624 NRS. If a prime contractor fails to submit such a list within the required time, their bid shall be deemed not responsive.

I have read and acknowledge that our company is in compliance with all WCSD Drug & Alcohol Requirements specified in Section 00800 – Supplementary General Conditions.

NOTE: **Any bid submission will be disqualified and rejected if the bid submission is not signed.** Washoe County School District only accepts signatures done manually (also known as a wet signature) or electronic digital signatures that are certified. Non-certified electronic digital signatures will NOT be accepted. A typed signature, even in cursive font, DOES NOT meet the requirements of an official digital signature. A digital signature must be accompanied by a certified digital stamp issued through programs like Adobe Acrobat, Docu-Sign or other similar programs that produce a digital stamp certifying the electronic digital signature. Any signatures on required forms that do not meet these requirements will not be accepted and the Contractor's submission will be deemed "Non-Responsive" and will be rejected. If you have any questions about this requirement, please submit your question by the question deadline, so that it can be answered prior to bid submission deadline.

Interested parties may NOT contact anyone else regarding this solicitation. Any interested Bidder contacting any other individual including, but not limited to, WCSD staff, officials, evaluation committee members, or Board of Trustees may have their Bid submission rejected from evaluation and award consideration.

BID #: 27-17-B-09-BC

FIRM NAME:	NEVADA LICENSE #:
NAME OF AUTHORIZED REPRESENTATIVE:	
ADDRESS:	
PHONE #:	FAX #:
EMAIL ADDRESS:	DATE:
SIGNATURE:	

5% LIST

To be submitted with the bid in accordance with Article 5.2.1 of the General Conditions as modified and Chapter 338.141 of NRS. **If the Prime Contractor is performing any work, including Supervision, that is 5% or greater they must list themselves per NRS 338.**

PROJECT NAME: **Mini-Modernization at Libby Booth Elementary School**

BID #: **27-17-B-09-BC**

DESCRIPTION OF WORK	SUBCONTRACTOR	LICENSE #	MHD License

Signature: _____
Authorized Firm Representative

Title: _____ Date: _____

1% LIST

To be submitted within two (2) hours after bid opening in accordance with Chapter 338.141 of NRS. Since all Subcontractors listed on the Bidder's 5% List are over 1% of the Bid amount, those Subcontractors shall automatically be deemed incorporated into this 1% List and need not be re-listed below. **If there are no further Subcontractors to list, please write "NONE or "N/A" and sign document.**

PROJECT NAME: **Mini-Modernization at Libby Booth Elementary School**

BID #: **27-17-B-09-BC**

DESCRIPTION OF WORK	SUBCONTRACTOR	LICENSE #	MHD License

Signature: _____
Authorized Firm Representative

Title: _____ Date: _____

PREFERENTIAL BIDDER STATUS AFFIDAVIT FOR BIDS SUBMITTED IN ACCORDANCE WITH NRS 338.0117 VALUED $250,000 OR MORE

Although Washoe County School District prefers this form is submitted with the bid response, this form may be submitted within two (2) hours of the bid opening.

Note: The Certificate of Eligibility for Preferential Bidder Status issued by the State Contractor's Board must be submitted with the bid response.

I, _____ ("Affiant"), on behalf of _____ ("Contractor"), swear and affirm that in order to be in compliance with NRS 338.0117, and be eligible to receive a preference in bidding for Project No._____, Project Name _____ ("Project"), certify that for the duration of the project, collectively, and not on any specific day:

(a) At least 50 percent of the workers employed on the public work, including, without limitation, any employees of the contractor, applicant or design-build team and of any subcontractor engaged on the public work, will hold a valid driver's license or identification card issued by the Department of Motor Vehicles of the State of Nevada;

(b) All vehicles used primarily for the public work will be:

(1) Registered and partially apportioned to Nevada pursuant to the International Registration Plan, as adopted by the Department of Motor Vehicles pursuant to NRS 706.826; or

(2) Registered in this State;

(c) If applying to receive a preference in bidding pursuant to subsection 3 of NRS 338.1727 or subsection 2 of NRS 408.3886, at least 50 percent of the design professionals working on the public work, including, without limitation, employees of the design-build team and of any subcontractor or consultant engaged in the design of the public work, will have a valid driver's license or identification card issued by the Department of Motor Vehicles of the State of Nevada; and

(d) The contractor, applicant or design-build team and any subcontractor engaged on the public work will maintain and make available for inspection within this State his or her records concerning payroll relating to the public work.

If the contractor fails to comply with any requirements of this Affidavit, a public body may recover, by civil action against the party responsible for a failure to comply with a requirement of this affidavit, a penalty as described below for a failure to comply with a requirement of this affidavit. If a public body recovers a penalty pursuant to this subsection, the public body shall report to the State Contractors' Board the date of the failure to comply, the name of each entity which failed to comply and the cost of the contract to which the entity that failed to comply was a party. The Board shall maintain this information for not less than 6 years. Upon request, the Board shall provide this information to any public body or its authorized representative.

If a contractor, applicant or design-build team submits this affidavit, receives a preference in bidding described in this affidavit and is awarded the contract as a result of that preference, the contract between the contractor, applicant or design-build team and the public body, each contract between the contractor, applicant or design-build team and a subcontractor and each contract between a subcontractor and a lower tier subcontractor must provide that:

a) If a party to the contract causes the contractor, applicant or design-build team to fail to comply with a requirement of this affidavit, the party is liable to the public body for a penalty in the amount of 1 percent of the cost of the largest contract to which he or she is a party;

b) The right to recover the amount determined pursuant to paragraph (a) by the public body pursuant to this affidavit may be enforced by the public body directly against the party that caused the failure to comply with a requirement of this affidavit; and

c) No other party to the contract is liable to the public body for a penalty.

By:_____ Title:_____
(Print Name of Affiant)

Signature of Affiant: _____ Date: _____

Signed and sworn to (or affirmed) before me on this _____ day of _____, 20_____, by_____ (name of Affiant).

State of _____)
)ss.
County of _____)

_____
Notary Signature
STAMP & SEAL

Proof of Authorization to Sign Affidavit

The person must establish his/her actual authority to act on behalf of the business organization. The individual must be the person indicated in the table below and provide written documentation clearly indicating the person's position within that business organization. If the individual signing the Affidavit is an employee of the business organization, written documentation, on organization letterhead, clearly indicating the person's authority to act on behalf of the business organization must be provided. The written documentation must be signed by the authorized person identified on the table.

If the individual making application for the business organization is not one of the persons identified in the table or an authorized employee, a valid power of attorney executed by an authorized person on behalf of the business organization must be provided. The power of attorney must be made not more than 90 days before the Affidavit is signed.

BUSINESS ENTITY	PERSON WHO HAS AUTHORITY TO COMPLETE AFFIDAVIT
Sole Proprietorship	Sole Proprietor
Partnership	A Partner
Corporation	1. Director, if Authorized 2. Executive Officer as indicated in the Article of Incorporation
Limited Liability Company	1. Member, if Member-Managed LLC 2. Manager, if Manager-Managed LLC

WASHOE COUNTY SCHOOL DISTRICT PUBLIC DISCLOSURE FORM

VENDOR/CONTRACTOR

THIS IS A REQUIRED FORM TO BE COMPLETED, SIGNED, AND SUBMITTED BY THE VENDOR/CONTRACTOR

VENDOR/CONTRACTOR (EMPLOYEE) FIRST/LAST NAME: _____

VENDOR/CONTRACTOR NAME: _____

I understand that per NRS 281A.020, a public office is a public trust and shall be held for the sole benefit of the people, and a public officer or employee must commit themself to avoid conflicts between the private interests of the public officer or employee and those of the general public whom the public officer or employee serves.

Furthermore, I understand that pursuant to Washoe County School District (WCSD) Board of Trustees Policy 4505 and per NRS 281A.400, WCSD employees (as public officers) shall not seek and/or accept any gift, work/service, favor, employment, engagement, emolument, and/or economic opportunity, including, but not limited to, unlawful compensation, salary, retainer, augmentation, expense allowance, commission, personal profit, pecuniary interest in the course of performing WCSD duties. In addition, WCSD employees (as public officers) shall not use their positions to secure and/or grant unwarranted privileges, preferences, exemptions, and/or advantages for the public officer or employee with any business entity.

By signing this form, I certify and acknowledge that I am a duly authorized agent of the VENDOR/CONTRACTOR named above and that failure to disclose all facts relative to a conflict and/or potential conflict of interest (ethical standards) with regard to the specific solicitation, project, and/or contract to which the VENDOR/CONTRACTOR named above is submitting to WCSD may result in a rejection of said solicitation, project, and/or submission and/or termination of any resulting contract should the above-named VENDOR/CONTRACTOR be selected and/or awarded. Furthermore, I also certify that I have completed the following and have provided true and accurate information to the best of my knowledge:

A. I certify that, to the best of my knowledge, **NO** current or former WCSD employees, officers, or trustees have a private pecuniary interest in the VENDOR/CONTRACTOR. ☐ **AGREE** ☐ **DISAGREE**

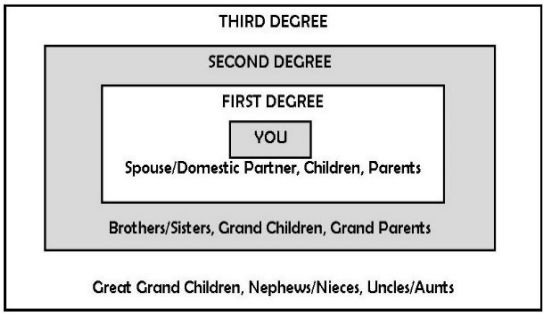
If you DISAGREE and cannot certify, then please explain:

_____
_____
_____

B. To the third degree of consanguinity (refer to the chart below), I have listed all of my and the principal(s) and key personnel of my organization's personal relationships, partnerships, correlations, and relatives (by blood and/or marriage) between WCSD, Officers of WCSD, key employees of WCSD, current and former WCSD Board of Trustees members and any other current and former WCSD personnel. ☐ **AGREE** ☐ **DISAGREE**

If you DISAGREE and cannot certify, then please explain:

_____
_____
_____



SIGNATURE: _____ **DATE**: _____

BID BOND

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned _____, as Principal, and _____ as Surety, are hereby held and firmly bound unto the Board of Trustees, Washoe County School District, as Owner, in the sum of _____ _____ Dollars ($_____) for payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

Signed this _____ day of _____, 20____.

The condition of the above obligation is such that whereas the Principal has submitted to the Board of Trustees, Washoe County School District, a certain bid, attached hereto and hereby made a part hereof, to enter into a Contract in writing for: _____ _____.

NOW, THEREFORE, if said bid shall be rejected, or in the alternative, if said bid shall be accepted and the Principal shall execute and deliver a Contract in the form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a Bond for its faithful performance of said Contract, and a Bond for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the contract created by the acceptance of said Bid, then this obligation shall be void.

Otherwise, the same shall remain in force and effect, and the sum herein specified paid over to the Owner; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within

which the Owner may accept such bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their officers, the day and year first set forth above.

_____

_____

Principal

(Seal) By: _____

_____

Surety

By: _____

Address:

(Seal)

_____

_____

_____

Phone: _____

LABOR AND MATERIALS BOND

KNOW ALL PERSONS BY THESE PRESENTS: That WHEREAS, the Board of Trustees, Washoe County School District in the State of Nevada has awarded to_____, hereinafter designated as “Principal”, a contract dated _____, for _____ _____ a copy of which contract is attached hereto and by reference made a part hereof, and hereinafter referred to as the “Contract”.

And WHEREAS, said Principal is required under the terms of said Contract and by law under the provisions of N.R.S. 339 to furnish a Bond for the labor and materials used in said Contract;

NOW, THEREFORE, we, the Principal, and _____ _____, as Surety, are held and firmly bound unto the Board of Trustees, Washoe County School District in the State of Nevada in the sum of _____ Dollars ($_____), lawful money of the United States, being not less than one hundred percent (100%) of the estimated Contract cost of the work, for the payment of which sum will and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if the above-bounden Principal, or its heirs, executors, administrators, successors or assigns shall fail to pay for any materials, provisions, supplies implements or machinery used in, upon, for, or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, or for amounts due under the Unemployment Compensation Law with respect to such work or labor, as required by the Provisions of N.R.S. 339, the Surety hereon will pay for the same within thirty (30) calendar days an amount not exceeding the sum specified in this bond, and the above obligation shall then be null and void. Otherwise, it shall remain in full force and virtue.

THE SURETY, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to the work to be

performed thereunder, or to the specifications accompanying the same, shall in any way affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work, or to the specifications.

And the said Surety, for value received, further stipulates and agrees that should the Board of Trustees, Washoe County School District, or other obligees, incur attorney's fees or other expenses for the enforcement of the Contract or this bond, the same shall be paid by the Surety to the contracting body, subcontractors, workmen laborers, mechanics and furnishers of material as their interests may appear.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their seals this_____ day of _____, 20_____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____

_____
Principal

(Seal) By: _____

_____
Surety

By: _____

Address:

(Seal)

_____

_____

_____

Phone: _____

PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS: That WHEREAS, the Board of Trustees, Washoe County School District in the State of Nevada has awarded to _____,
Hereinafter designated as “Principal”: a contract dated _____,
for _____
_____
a copy of which contract is attached hereto and by reference made a part hereof, and hereinafter referred to as the “Contract”.

And WHEREAS, said Principal is required under the terms of said Contract and by law under the provisions of N.R.S. 339 to furnish a Bond for the faithful performance of said Contract;

NOW, THEREFORE, we, the Principal, and _____
_____, as Surety, are held and firmly bound unto the Board of Trustees, Washoe County School District in the State of Nevada in the sum of
_____
Dollars ($_____), lawful money of the United States, being no less than one hundred per cent (100%) of the estimated Contract Cost of the work, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if the above bounden Principal, or its heirs, executors, administrators, successors, or assigns, shall in all things stand to and abide by and well and truly keep the faithfully perform the covenants, conditions, and agreements in the Contract and any alterations made as therein provided, on his or its part to be kept and performed at the respects according to their true intent and meaning; and shall indemnify and save harmless the Board of Trustees, Washoe County School District in the State of Nevada, its officers and agents, as therein stipulated; then this obligation shall become null and void. Otherwise, it shall be and remain in full force and virtue.

As a condition precedent to the satisfactory completion of the Contract, the above obligation shall hold good for a period of one (1) year after completion and acceptance of the work done, during which time if the above-bounden Principal, his or its heirs, executors, administrators, successors, or assigns shall fail to make full, complete, and satisfactory repair and replacements or totally protect the Board of Trustees, Washoe County School District in the State of Nevada from loss or damage made evident during said period of one (1) year from the date of acceptance of said work, and resulting from or caused by defective materials or faulty workmanship in the prosecution of the work done, the above obligation in the said sum of _____ Dollars ($_____) shall remain in full force and virtue; otherwise, the above obligation shall be void.

THE SURETY, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to the work to be performed thereunder, or to the specifications accompanying the same, shall in anyway affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the work, or to the specifications.

And the said Surety, for value received, further stipulates and agrees that should the Board of Trustees, Washoe County School District, incur attorney's fees or other expenses for the enforcement of the Contract or his/her bond, the same shall be paid by the Surety to the Board of Trustees, Washoe County School District.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their seals this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____

_____

Principal

(Seal)

By: _____

_____

Surety

By: _____

Address:

(Seal)

_____

_____

_____

Phone: _____

SECTION 01001 – CONSTRUCTION PROCEDURES FOR EXISTING SCHOOL SITES

PART 1 – GENERAL

1.1 DESCRIPTION

A. All work activities under this contract shall be coordinated with the requirements of the Washoe County School District's (WCSD) Facilities Management Department. WCSD shall be contacted prior to any service shutdown and advised when such shutdown shall be commenced. All materials and equipment shall be stored in spaces assigned by WCSD. The Contractor will be required to maintain a neat and orderly operation and to limit or keep noise and nuisance to a minimum.

B. WCSD reserves the right to remove any person from the property for the safety and security of the facility

1.2 GENERAL REQUIREMENTS FOR WORK INSIDE THE EXISTING PERIMETER AND EXISTING BUILDINGS

A. It is a felony to transport any alcoholic beverages, drugs, weapons or ammunition of any kind on WCSD property

B. Any contact or conversation with students is prohibited.

C. Smoking is prohibited on all WCSD property.

D. Working hours inside the existing perimeter and existing building will be coordinated with WCSD.

E. Storage of materials inside the existing perimeter and buildings will be coordinated with WCSD Facilities Management Department.

F. Construction operations shall be confined to the areas permitted under the contract. Areas beyond indicated work areas are not to be disturbed. Conform to site rules and regulations affecting the work.

G. Keep driveways and entrances serving the premises clear and available at all times. Do not use these areas for parking or storage of materials.

H. Passenger cars, trucks and motorized construction equipment, when parked and unattended, shall be locked and the ignition key removed. Do not leave any such vehicle with the motor running.

I. Limitations on site usage, as well as specific requirements that impact site utilization are indicated on the drawings and any other contract documents. Allocate available space equitably among sub-contractors needing both access and space so as to produce the best overall efficiency. Schedule deliveries to minimize space and time requirements for storage of materials and equipment.

J. All refuse will be removed daily.
K. Contractor may work on playground areas within temporary fenced enclosure.
L. No vehicles, deliveries, workman and equipment shall be outside of fenced enclosure while students are present on playground.
M. Noise activities that affect adjacent classroom spaces shall be performed during non-school hours.
N. No utility disruptions shall occur during school hours.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01001

SECTION 01010 - SUMMARY OF WORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all contract documents and addendums associated with this project shall apply to this section.

1.2 PROJECT DESCRIPTION

A. Project to entail work as described in scope of work.

B. The project shall consist of all on and off-site improvements, as shown in the contract documents.

1.3 CONTRACTOR USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises (construction area) for construction operations. The Contractor's use of the premises (construction area) is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of project.

B. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment site.

1.4 OWNER OCCUPANCY

A. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building, prior to substantial completion provided that such occupancy does not interfere with completion of the work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total work.

1.5 OWNER FURNISHED ITEMS

A. The Owner will provide certain pieces of equipment and accessories that are to be installed and connected by the Contractor.

1. The Owner will arrange and pay for delivery of Owner furnished items in accordance with the Contractor's construction schedule, and will inspect deliveries for damage.

2. If Owner furnished items are damaged, defective or missing, the Owner will arrange for replacement. The Owner will also arrange for manufacturer's field

services and the delivery of manufacturer's warranties and bonds to the Contractor.

3. The Contractor is responsible for designating the delivery dates of Owner furnished items in the Contractor's construction schedule and for receiving, unloading and handling Owner furnished items at the site. The Contractor is responsible for protecting Owner furnished items from damage, including damage from exposure to the elements, and to repair or replace items damaged as a result of the Contractor's operations.

4. Owner furnished and Contractor installed and connected equipment shall be as indicated in the contract documents.

END OF SECTION 01010

SECTION 01015 – SCHEDULE OF DRAWINGS

General
G100 Title Sheet
G101 Project Data
G102 Code Analysis
G103 Building Envelope Compliance
G210 Fire Protection Assemblies
G211 Fire Protection Assemblies
G212 Fire Protection Assemblies
G301 Accessibilty Diagrams
G401 Wall Types
G402 Typical Metal Stud Framing Details
G501 Signage Details
G511 Signage Plan

Civil
C101 Civil Overall Site Plan, Demo Plan & Notes
C102 Site Plan
C103 Civil Screen Wall Plan and Profile
C201 Grading Plan
C301 Utility Plan
C401 Civil Details
C402 Civil Details
C403 Civil Details

Architectural
A001 Site Plan
A002 Site Wall Elevations
A101 Floor Plan
A102 Roof Access Mezzanine Plan
A131 Enlarged Restroom Plans and Elevations
A201 Roof Plan
A211 Roof Details
A212 Roof Details
A301 Exterior Elevations
A401 Building Sections
A411 Wall Sections
A412 Wall Sections
A413 Wall Sections
A501 Ships Ladder Details
A601 Reflected Ceiling Plan
A611 Ceiling Details
A701 Door Schedule, Frame Elevations
A702 Door Details
A703 Aluminum Frame Details
A704 Aluminum Frame Details
A801 Finish Plan
A811 Room Finish Schedule and Interior Elevations
A812 Interior Elevations
A822 Details
A831 Accent Paint Plan

SECTION 01015 – SCHEDULE OF DRAWINGS

Structural
S001 Structural Cover Sheet
S002 General Notes
S003 Quality Assurance
S011 Typical Earthwork and Concrete Details
S012 Typical Concrete Details
S031 Typical Masonry Details
S032 Typical Masonry Details
S041 Typical Steel Details
S042 Typical Steel Details
S043 Typical Steel Details
S051 Typical Metal Stud Details
S101 Foundation and Level 1 Plan
S111 Low Roof and Mezzanine Framing Plan
S121 High Roof Framing Plan
S131 Joist Design Criteria, Snow Load and Collector Force Diagram
S132 Component and Cladding Wind Pressure Diagram
S201 Wall Elevations
S202 Wall Elevations
S203 Wall Elevations
S301 Foundation Details
S401 Mezzanine Framing Details
S501 Framing Details
S502 Framing Details

Mechanical
M001 Mechanical Schedules, Legends, and Notes
M002 Mechanical Schedules
M010 Mechanical Site Plan
M100 Mechanical Zoning Plan
M101 Mechanical Floor Plan
M200 Mechanical Roof Plan
M601 Mechanical Details
M602 Mechanical Details
M701 Temperature Controls

Plumbing
P001 Plumbing Schedules, Legends, and Notes
P002 Plumbing Site Plan
P102 Plumbing Overall Floor Plan W&V
P103 Plumbing Overall Floor Plan W&U
P200 Plumbing Overall Roof Plan
P601 Plumbing Details

Electrical
E001 Electrical & Fire Alarm Legends and Drawing Schedule
E002 Fixture Schedule & IECC Compliance
E003 Oneline Diagram & Panel Schedules
E004 Electrical Details
E101 Electrical Site Plan

E201 Lighting Plans
E202 Daylight Harvesting Zones Plan
E301 Power Plan
E401 Mechanical Power Plan
E402 Roof Mechanical Power Plan
E501 Fire Alarm Plan

Telecom
T001 Telecom Legend, General Notes, and Drawing Schedule
T011 Telecom Details
T012 Telecom Details
T021 Telecom Diagrams
T022 Telecom Diagrams
T023 Telecom Diagrams
T031 Telecom Schedules
T101 Telecom Site Plan
T201 Telecom Plan
T211 Security Plan
T301 Telecom Enlarged Plans

G100 Title Sheet
General
G101 Project Data
G102 Code Analysis
G301 Accessibilty Diagrams
G401 Wall Types, and Wall Details
G402 Metal Stud Framing Details
G501 Signage Details
G511 Signage Floor Plan and Schedule - B-Wing
G512 Signage Floor Plan - D-Wing

Architectural Demolition
A001 Overall Site Plan
AD101 Overall Existing Floor Plan
AD111 Demolition Plan - B-Wing
AD112 Demolition Plan - D-Wing
AD113 Demolition and Alteration Plans - Modular
AD301 Demolition Exterior and Interior Elevations
AD401 Demolition Wall Sections
AD601 Demolition Reflected Ceiling Plan - B-Wing
AD602 Demolition Reflected Ceiling Plan - D-Wing

Architectural
A101 Overall Alteration Floor Plan
A111 Alteration Plan - B-Wing
A112 Alteration Plan - D-Wing
A120 Miscellaneous Details
A301 Exterior Elevations
A302 Exterior Elevations
A303 Bid Alternate #1 New Paint Portables Exterior Elevations
A401 Building Sections and Wall Sections

A601 Alteration Reflected Ceiling Plan - B-Wing
A602 Alteration Reflected Ceiling Plan - D-Wing
A610 Reflected Ceiling Details
A701 Door Schedule, Door Types, Frame Elevations, and Frame Details
A801 Room Finish Schedule, and Interior Elevations
A802 Interior Elevations - Paint
A803 Finish Floor Plan and Accent Paint Floor Plan - B-Wing
A804 Finish Floor Plan D-Wing
A805 Accent Paint Plan D-Wing
A810 Interior Details

Structural
S001 Structural Cover Sheet
S002 General Notes
S003 Quality Assurance
S011 Typical Details
SD111 Demolition Plans - 'B' Wing
S111 Plans - 'B' Wing

Mechanical
M001 Mechanical Schedules, Legends, & Notes
M101 Mechanical Overall Alteration Floor Plan
M110 Mechanical Zoning Plan - B-Wing
M111 Mechanical Demolition Plan - B-Wing
M112 Mechanical Demolition Plan - D-Wing
M211 Mechanical Alteration Plan - B-Wing
M212 Mechanical Alteration Plan - D-Wing
M301 Mechanical Roof Plan
M601 Mechanical Details

Plumbing
P001 Plumbing Schedules, Legends, & Notes
P101 Plumbing Overall Alteration Floor Plan
P111 Plumbing Demolition Plan - B-Wing W&V
P112 Plumbing Demolition Plan - D-Wing W&V
P113 Plumbing Demolition Plan - B-Wing DW&U
P114 Plumbing Demolition Plan - D-Wing DW&U
P211 Plumbing Alteration Plan - B-Wing W&V
P212 Plumbing Alteration Plan - D-Wing W&V
P213 Plumbing Alteration Plan - B-Wing DW&U
P214 Plumbing Alteration Plan - D-Wing DW&U

Fire Protection
FP101 Fire Protection Overall Alteration Floor Plan
Electrical
E001 Electrical & Fire Alarm Legends and Drawing Schedule
E011 Electrical Details
E021 Oneline Diagram
E031 Fixture Schedule, Panel Schedule, and IECC Compliance
E100 Electrical Site Plan
E101 Electrical Demolition Plan

E201 Lighting Plan
E301 Power Plan
E302 Power Basement Plan
E401 Fire Alarm Plan

Telecom
T001 Telecom Legend, Notes, and Drawing Schedule
T011 Telecom Details
T012 Telecom Details
T021 Telecom Diagrams
T022 Telecom Diagrams
T031 Telecom Schedules
T101 Telecom Site Plan
T201 Telecom Plan
T202 Telecom Basement Plan
T221 Security Plan - East
T222 Security Plan - West
T301 Telecom Enlarged Plans
TD201 Telecom Demolition Plan

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for submittals required for performance of the work for all entities/individuals including, but not limited to, the following:

1. General Contractor
2. Sub-Contractor
3. Sub-Contractor of Sub-Contractor
4. Quality Control Personnel
5. Special Inspection Personnel
6. Security Personnel
7. Consultant Personnel

B. Administrative Submittals: Refer to other Division 1 sections and other Contract Documents for requirements for administrative submittals.

1.3 SUBMITTAL PROCEDURES

A. Required Submittals

1. Each company, engaged on a project, shall report to the Washoe County School District all required certifications for every employee who will be on a Washoe County School District site. This includes all personnel whom the Contractor engages for work on the project site as defined in 1.2 (A). This information must be submitted within twenty-one (21) calendar days prior to commencement of work by the Contractor, and any sub-contractor, regardless of tier. Such submittals required include:

a. Certification by Company Regarding Personnel Safety Check Application.

PART 2- PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

CERTIFICATION BY COMPANY REGARDING PERSONNEL SAFETY CHECK APPLICATION

Washoe County School District – Capital Improvement Projects

I certify on behalf of the company/firm named below that adequate background check procedures have been or will be performed for all employees that will work on Washoe County School District project _____ (Project Name) regarding _____ (Company/Firm Name) to determine that their employees meet the qualifications required by the Washoe County School District.

With this certification, I confirm that:

- All employees working on a Washoe County School District project shall not have been arrested, convicted, pled guilty, or pled nolo contender for any offenses related to:
  - Sexual assault or sexual activities with a minor
  - Child abuse
  - Felony drug possession
  - Felony weapons possession
- All employees working on a Washoe County School District project shall not:
  - Have any active Wants/Warrants
  - Is a Registered Sex Offender
  - Is on a Terrorist list.

I understand that the Washoe County School District maintains the right to remove any individuals from the project who do not comply with the above requirements.

I certify the information provided on this application is true, complete, and correct to the best of my knowledge and belief and is provided in good faith. I understand that a knowing and willful false statement on this application can be an automatic disqualification.

I hereby release, discharge, exonerate and hold harmless the Washoe County School District, its agents and representatives and persons furnishing information from any and all liability arising out of the disseminating and inspection of my records.

_____

Company/Firm Name

_____ _____

Name of Executive Officer Title

_____ _____

Signature Date

SECTION 01027 – APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. Related Sections: The following sections contain requirements that relate to this section.

1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in SECTION 01300 - SUBMITTALS.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

a. Contractor's Construction Schedule
b. Application for Payment forms, including continuation sheets
c. List of all tier Sub-Contractors
d. List of products
e. List of principal suppliers and fabricators
f. Schedule of Submittals
g. Schedule of Allowances
h. Schedule of Alternates

2. Submit the Schedule of Values to the Architect at the earliest possible date but no later than seven (7) calendar days before the date scheduled for submittal of the initial Application for Payment.

3. Sub-schedules: Where Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for

each Specification Section by site improvements, by each individual building new or addition construction, and by each individual building remodel or revitalization.

1. Arrange Schedule with subtotals for the following:
    a. General Conditions
    b. Fee including overhead, proffit, all insurances
    c. Site Improvements
    d. Each individual building new or addition;
    e. Each individual building remodel or revitilization

2. Identification: Include the following Project identification on the Schedule of Values:

    a. Project name and location
    b. Name of the Architect
    c. Project Number
    d. Contractor's name and address
    e. Date of submittal

3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division including general conditions broken down catagorically.
    b. Description of Work
    c. Name of Sub-Contractor
    d. Name of manufacturer or fabricator
    e. Generic Name of supplier
    f. Change Orders (numbers) that affect value
    g. Dollar value

        1. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

4. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Application for Payment and progress reports. Coordinate with the Project Manual Table of Contents. Break principal subcontract amounts down into several line items. Include a line item for Force Accounts and unit price items, as applicable.

5. The total shall equal the Contract Sum.

6. For each part of the work where an Application for Payment may include materials or equipment, purchased or fabricated and stored on or off-site, provide separate line items on the Schedule of Values for cost of those materials.

a. If the Contractor is requesting payment for materials or equipment that are stored off-site, those materials must be stored in a bonded and insured third party warehouse, and they must be segregated from other stored materials and they shall be identified according to project name, material and/or equipment description, and quatity. These materials must be observed in their stored condition by either the Architect or the Owner's representative prior to approval of the Application for Payment. In lieu of bond for stored materials offsite the contractor/subcontractor may provide an appropriate insurance policy approved by the owner to provide for the full replacement cost coverage for all materials stored. Any coverage for materials or equipment stored off-site shall include Owner as loss payee with respect to its interests. These materials must be observed in their stored condition by either the Architect or the Owner's representatives prior to approval of the Application for Payment.

b. All stored material payment requests shall include material supplier invoicing and shall not include labor or delivery costs.

7. Temporary facilities and other major cost items that are not direct cost of actual work-in-place shall be shown as separate line items in the Schedule of Values

a. General Conditions shall be broken down by major cost items and catagories including breakout of labor and material.

b. General Conditions performed by subcontract work shall be broken down to individual catagories on the schedule of values. No internal changes to subcontracts shall be allowed without formal Change Order Documentation and reflected on the schedule of values.

8. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and Owner's representative and paid for by the Owner.

1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements

C. Each application for payment shall include sufficient documentation to substantiate completed work including but not limited to: subcontractor invoicing, all tiers; general conditions cost breakdown, etc.

C. Payment Application Times: The date for each progress payment is as indicated in the Contract. The period covered by each Application for Payment is the period indicated in the Contract.

D. Payment Application Forms: Use Washoe County School District Certificate for Payment form only. This form is available in both hard copy format or electronic format.

E. Application Preparation: Complete every entry on the form. The execution of this form shall be by a person authorized to sign legal documents on behalf of the Contractor. The Owner will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.

2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

F. Pre-Approval of Application: Percentages of completed work are to be verified by the Owner’s Representative and Architect prior to transmittal to the Architect.

1. It shall be established at the Pre-Construction meeting the protocols that are acceptable to each party for the review of payment application percentages.

G. Record Drawings and Record Specifications: Prior to transmittal of the Application for Payment, Record Drawings and Record Specifications must be reviewed and approved by the Owner’s Representative and Architect.

1. It shall be established at the Pre-Construction meeting the protocols that are acceptable to each party for the review of Record Drawings and Specifications.

H. Transmittal: Submit one (1) signed original copy of each Application for Payment to the Architect by a method ensuring receipt within twenty-four (24) hours. The submitted copy shall be complete, including waivers of lien and similar attachments, when required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.

2. Obtain Owner’s Representative’s initials as established during the Pre-Construction meeting and in sub-section 1.4, items E & F above.

I. Waivers of Mechanic’s Lien: With each Application for Payment, submit conditional waivers of mechanic’s lien from every entity who is lawfully entitled to file a

mechanic's lien arising out of the Contract and related to the work covered by the payment.

1. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.

J. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:

1. List of Sub-Contractors (all tiers)
2. List of principal suppliers and fabricators
3. Schedule of Values
4. Contractor's Construction Schedule
5. Schedule of principal products
6. Submittal Schedule
7. List of Contractor's staff assignments
8. List of Contractor's principal consultants
9. Copies of Building Permits
10. Copies of authorizations and licenses from governing authorities for performance of the work
11. Initial Progress Report
12. Report of Pre-Construction meeting
13. Data needed to acquire the Owner's insurance
14. Initial settlement survey and damage report, if required, (existing faclity condition)
15. Record Drawings *
16. Record Specifications*

* Record Drawings and Specifications must be reviewed and approved by the Owner's Representative prior to the Application for Payment.

K. Continuing Application for Payments: Administrative actions and submittals, that must precede or coincide with submittal of the Application for Payment, include the following:

1. Updated Contractor's Construction Schedule

2. Progress report

3. Record Drawings*

4. Record Specifications*

*Record Drawings and Specifications must be reviewed and approved by the Owner’s Representative prior to the Application for Payment.

L. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the work.

2. Administrative actions and submittals that shall precede or coincide with this application include:

a. Occupancy permits and similar approvals
b. Changeover information related to Owner's occupancy, use, operation, and maintenance
c. Final cleaning
d. Application for reduction of retainage and consent of surety
e. Advice on shifting insurance coverages
f. List of incomplete work, recognized as exceptions to Architect's Certificate of Substantial Completion
g. Record Drawings*
h. Record Specifications*
i. Meter Readings
j. Change of door locks to Owner's access

*Record Drawings and Specifications must be reviewed and approved by the Owner’s Representative prior to the Application for Payment.

M. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:

1. Completion of project closeout requirements

2. Completion of items specified for completion after Substantial Completion

3. Ensure that unsettled claims will be settled
4. Ensure that incomplete work is not accepted and will be completed without undue delay
5. Completion and final reporting of all prevailing wage and apprentice utilization including unsettled prevailing wage and apprentice utilization claims
6. Transmittal of required project construction records to the Owner
7. Proof that taxes, fees, and similar obligations were paid
8. Removal of temporary facilities and services
9. Removal of surplus materials, rubbish, and similar elements
10. Certified property survey
11. Warranties (Guarantees) and Maintenance Agreements
12. Test/adjust/balance records
13. Operation and Maintenance Manuals
14. Startup performance reports
15. Final progress photographs

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01030 – ALTERNATES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section includes administrative and procedural requirements for Alternates.

B. This section identifies each Alternate by number and describes the basic changes to be incorporated into the work when each Alternate is made a part of the work by specific provisions in the Agreement between the Owner and Contractor.

C. The contract documents sections referenced within the respective Alternates describe the general requirements for the work under each Alternate.

1.02 DEFINITIONS

A. An Alternate (or Alternate Bid) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the work, as described in this section, is accepted by the Owner.

B. Refer to the contract documents for further information.

1.03 PROCEDURES

A. Coordinate related work and modify surrounding work as required to integrate the various elements of the Alternates in the complete work. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated or specified as part of the Alternate.

B. Immediately following award of the contract, notify in writing parties involved of the status of each Alternate. Indicate if Alternate has been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to Alternates, if any.

C. Execute accepted Alternates under the same conditions as other work of the Contract.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.01 PREPARATION

A. Base Bid shall include all site work, architectural, structural, mechanical, electrical, food service and all other work as required to render the facility complete and operable except for the Add Alterations as described in this section.

((COMPLETE THE FOLLOWING SCHEDULE AS REQUIRED
FOR THE SPECIFIC WORK TO BE INCLUDED AS AN ALTERNATE))

3.02 SCHEDULE OF ALTERNATES

A. ALTERNATE NO. 1

1. General: Repaint the exterior of the two (2) portables.

END OF SECTION 01030

SECTION 01035 - MODIFICATION PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section specifies administrative and procedural requirements for handling and processing contract modifications.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 1 SECTION 01300 – SUBMITTALS for requirements for the Contractor's Construction Schedule.

2. Division 1 SECTION 01027 – APPLICATIONS FOR PAYMENT for administrative procedures governing Applications for Payment.

3. Division 1 SECTION 01631 – SUBSTITUTIONS for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 MINOR CHANGES IN THE WORK

A. The Architect will issue supplemental instructions authorizing minor changes in the work, not involving adjustment to the contract sum or contract time, as an Architect's Supplemental Instruction.

1.4 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the work that will require adjustment to the contract sum or contract time. If necessary, the description will include supplemental or revised drawings and specifications.

1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.

2. Within fourteen (14) working days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.

a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

b. Indicate applicable taxes, delivery charges, equipment rental and amounts of trade discounts.

c. Include a statement indicating the effect the proposed change in the work will have on the contract time.

d. Include all subcontractor and contractor overhead and profit per contract documents.

B. Contractor-Initiated Proposals: When latent or unforseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.

1. Include a statement outlining the reasons for the change and the effect of the change on the work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the contract sum and contract time.

2. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Comply with requirements in SECTION 01631 – SUBSTITUTIONS if the proposed change requires substitution of one product or system for a product or system specified.

5. Include a list of all associated cost that would be incurred, including subcontractor and contractor overhead and profit per contract documents.

C. The Contractor shall prepare his response in accordance with the requirements set forth in the General Conditions.

D. Proposal Request Form: Use AIA Document G709-2001 for Change Order Proposal Requests or Change Order Request Form (CP-F107).

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Owner and Architect may issue a Construction

Change Directive.The Construction Change Directive instructs the Contractor to proceed with a change in the work, for subsequent inclusion in a Change Order. The Construction Change Directive will be approved upon email confirmation from the Owner.

1. The Construction Change Directive contains a complete description of the change in the work. It also designates the method to be followed to determine change in the contract sum or contract time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

C. Notification: Contractor shall notify Owner prior to any “Not to Exceed” items being over run. Additional Construction Change Directive may be required for over run work.

1.6 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701-2000/2001 or WCSD’s Change Order Form (CP-F107).

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01035

ARCHITECT / OWNER

SAMPLE PRICE REQUEST

Date: _____Price Request #_____

Contractor: _____

Bid/Quote #: _____

Project: _____

Please submit a Price Quotation for the following changes being considered. Quote the change within fourteen (14) calendar days - ADD or DEDUCT - in the Contract Sum and any change in the Contract Time. Also, please state how long the price quoted is effective before job conditions warrant an increase in price. This is NOT authorization to proceed with this work.

REFERENCE: _____
_____
_____
_____

CHANGE: _____
_____
_____
_____

REQUESTED BY: _____

REASON: _____
_____
_____

CONTRACTOR / OWNER

SAMPLE CHANGE ORDER REQUEST

Date: _____Price Request #_____

Contractor: _____

Bid/Quote #: _____

Project: _____

Please submit a Price Quotation for the following changes being considered. Quote the change within five (14) calendar days - ADD or DEDUCT - in the Contract Sum and any change in the Contract Time. Also, please state how long the price quoted is effective before job conditions warrant an increase in price. This is NOT authorization to proceed with this work.

REFERENCE: _____
_____
_____
_____

CHANGE: _____
_____
_____
_____

REQUESTED BY: _____

REASON: _____
_____
_____
_____

SAMPLE CLARIFICATION

DATE: _____

TO: _____

FROM: _____

SUBJECT: _____

REFERENCE: _____
_____
_____
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CLARIFICATION: _____
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THIS INFORMATION IS PROVIDED FOR CLARIFICATION ONLY AND DOES NOT INVOLVE ANY CHANGE IN CONTRACT PRICE OR TIME.

SIGNATURE: _____

TITLE: _____

DATE: _____CLAR. NO.: _____

SAMPLE REQUEST FOR INFORMATION

DATE: _____

TO: _____

FROM: _____

SUBJECT: _____

REFERENCE:
Specification Section: _____ Paragraph: _____
Drawing Number: _____Details: _____

INFORMATION REQUIRED: _____
_____
_____
_____

SIGNATURE: _____

TITLE: _____

DATE: _____

REPLY TO ABOVE RFI: _____
_____
_____
_____

THIS INFORMATION IS PROVIDED FOR CLARIFICATION ONLY AND DOES NOT INVOLVE ANY CHANGE IN CONTRACT PRICE OR TIME.

SIGNATURE: _____

TITLE: _____

DATE: _____CLAR. NO.: _____

SECTION 01040 – COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. General project coordination procedures

2. Conservation

3. Coordination Drawings

4. Administrative and supervisory personnel

5. Cleaning and protection

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 1 Section 01050 – FIELD ENGINEERING specifies procedures for field engineering services, including establishment of benchmarks and control points.

2. Division 1 Section 01200 – PROJECT MEETING for progress meetings, coordination meetings, and pre-installation conferences.

3. Division 1 Section 01300 – SUBMITTALS for preparing and submitting the Contractor's construction schedule.

4. Division 1 Section 01600 – MATERIALS AND EQUIPMENT for coordinating general installation.

5. Division 1 Section 01700 – CONTRACT CLOSEOUT for coordinating contract closeout.

1.3 COORDINATION

A. Coordinate construction operations included in various sections of these Specifications to assure efficient and orderly installation of each part of the work.

Coordinate construction operations included under different sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

3. Make provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination, include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules

2. Installation and removal of temporary facilities

3. Delivery and processing of submittals

4. Progress meetings

5. Project closeout activities

D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work.

E. Coordinate the installation of all motor starters. General Contractor is responsible for costs associated with supplying and installing <u>all</u> required motor starters.

F. Dimensions: The Structural drawings are to be used in conjunction with the Architectural, Mechanical and Electrical drawings. Primary structural elements are dimensioned on the structural plans and details. Not all secondary dimensions are shown, such as exact door and window locations, wall configurations, slab slopes, depressions, curbs, etc. Coordination of the structure of the dimensions as shown on the drawings and architectural items to be embedded into, or attached to the structure, is the responsibility of the Contractor. Any dimensions discrepancies between the Architectural, Civil Structural, Mechanical and Electrical drawings shall be reported to the Owner's Representative and Architect before proceeding with the work.

G. Intent of Drawings:

1. The work of the Contractor and subcontractor shall conform to the intent of the architectural and coordination drawings as reviewed by the Architect. Drawings are partly diagrammatic and do not intend to show in details all features of work. The Contractor shall carefully review the work to be performed by other trades, compare related drawings and shall thoroughly understand the building conditions affecting their work.

2. All changes required in the work caused by failure to do so shall be at no expense to the Owner.

H. Interfaces and Right-of-Way:

1. Make proper provisions to avoid interfaces.

2. Where conflicts occur, architectural and structural has right-of-way over mechanical and electrical work; concealed mechanical work has right-of-way over concealed electrical work; exposed electrical fixtures have right-of-way over mechanical fixtures.

3. Submit conflicts which cannot be resolved by right-of-way to the Owner for direction.

4. Submit reflected ceiling coordination plans showing work by all applicable trades for review and approval by the Architect.

I. Masonry Wall Coordination Drawings:

1. Contractor shall be responsible for providing masonry wall coordination drawings for all concrete masonry unit walls. Drawings shall consist of wall elevations drawn to scale at not less than ¼" = 1'0".

2. Wall elevations shall include dimensioned sizes and locations for all door, window and mechanical openings and penetrations, beam and joist

bearing pockets, ledger angles, embedded plate connections, and anchor bolts. All miscellaneous steel to be embedded in the masonry unit wall shall be referenced by show drawing mark number or structural detail number.

3. Masonry wall coordination drawings shall be reviewed and approved by interfacing trades prior to submittal to the Architect. Shop drawings for masonry reinforcement shall be an 'overlay' of the masonry wall coordination drawings. Detail, fabricate and place per ACI 315. Reinforcing shop drawings elevations shall show all vertical and horizontal reinforcing layouts; special reinforcement at lintels and jams at doors, windows, mechanical openings and as called out on Structural drawings.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space of efficient installation of different components.

1. Show the relationship of components shown on separate Shop drawings.

2. Indicate required installation sequences.

3. Comply with requirements contained in Section 01300 - SUBMITTALS.

B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the project site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.

1. Post copies of the list in the Project Meeting Room, the temporary field office and each temporary telephone.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading
2. Excessive internal or external pressures
3. Excessively high or low temperatures
4. Thermal shock
5. Excessively high or low humidity
6. Air contamination or pollution
7. Water or ice
8. Solvents
9. Chemicals
10. Light
11. Radiation
12. Puncture
13. Abrasion
14. Heavy traffic
15. Soiling, staining and corrosion
16. Bacteria
17. Rodent and insect infestation
18. Combustion
19. Electrical current
20. High-speed operation
21. Improper lubrication
22. Unusual wear or other misuse
23. Contact between incompatible materials
24. Destructive testing
25. Misalignment
26. Excessive weathering
27. Unprotected storage

28. Improper shipping or handling
29. Theft
30. Vandalism

END OF SECTION 01040

1. SUMMARY

    a. Web based construction project management collaboration software to submit, track, distribute and collaborate on project documentation and action items.

    b. The intent of utilizing a web-based construction management application is to reduce cost and schedule risk, improve quality and safety, and maintain a healthy team dynamic by improving information flow, reducing non-productive activities, reducing rework and decreasing turnaround times.

    c. WCSD to work with Contractor to ensure directory for project is current and to be responsible for establishing and managing necessary permissions for users through duration of project.

    d. WCSD will hold a kickoff meeting with the Contractor and applicable consultants at the beginning of the project to discuss how the software will be used, routing & naming protocols, permissions & restrictions, roles & responsibilities, etc.

2. SOFTWARE CAPABILITIES (including but not limited to)

    a. Daily Log
        i. Provides daily log entry from web and mobile with automatic capture of daily weather conditions.
        ii. Provides ability to attach photographs to entries directly from mobile.
        iii. Provides reporting capabilities to easily report on man-hours and activities for a certain time frame and contractor.

    b. Dashboards
        i. Provides a dashboard that shows the status of all currently assigned items with drill down capability to see the subject, assignee and due date of each item.

    c. Deficiency Tracking
        i. Provides a means for recording, assigning and confirming completion of any deficiency or observation noted during the course of construction.

    d. Directory
        i. Provides a directory of all team member's contact information that is accessible from web and mobile.

    e. Documents
        i. Provides a storage location for miscellaneous project documents with the ability to have a folder hierarchy and privacy settings on folders.

ii. No storage limit.
iii. Provides download tracking.

f. Drawings
   i. Provides access to a system maintained current set of drawings on web and mobile, with access to all previous revisions as well.
   ii. Provides automatic hyperlinking capability for detail callouts.
   iii. Provides drawing markup capabilities on web and mobile.
   iv. Provides ability to link RFIs, Submittals, Punchlist Items, Photos and Project Documents to the drawings.
   v. Drawing Markups can be carried forward when new revisions are uploaded.
   vi. Markups and linked documentation are able to be public or private.

g. Financial Management
   i. Provides ability to manage contracts, payment applications and change orders.
   ii. Provides ability to view contracts and change orders from web and mobile.

h. Inspections
   i. Provides ability to create inspections from web and mobile.
   ii. Provides ability to create a deficiency item from an inspection that can be assigned and tracked to completion.

i. Meetings
   i. Provides ability to create, edit and view meeting minutes from web and mobile.
   ii. Provides ability to create action items with assignees and due dates from a meeting item.

j. Mobile Accessibility
   i. Provide native mobile applications for iOS and Android phones at a minimum that provide access to relevant project documentation, including as-built versions of Drawings and Specifications, even when there is no internet access.

k. Photos
   i. Provides ability to upload and view photos from web and mobile.
   ii. Provides ability to markup photos from mobile to clarify anything important in the photo.
   iii. Provides ability to link photos to specific locations on drawings.

l. Punchlist
   i. Provides ability to create punchlist items from web and mobile and link them to specific locations on the drawings.

ii. Provides ability to distribute punch list items to all contractors, for contractors to mark them as resolved with photographic proof of resolution via mobile, and for the items to be marked as complete via mobile or web.

m. Requests for Information (RFIs)
   i. Provides ability to create RFIs with assignees, due dates and attachments.
   ii. Provides ability for assignees to respond to RFIs both via the software and by responding to the system generated email.
   iii. Provides an auto-generated log of all RFIs.

n. Schedule
   i. Provides ability to display schedules from typical scheduling software.

o. Specifications
   i. Provides ability to upload project specifications and manage them at the individual specification level.
   ii. Provides ability to view and search specifications on web and mobile.
   iii. Provides ability to upload revisions to individual specifications and maintain all revision history.
   iv. Provides an auto-generated current specification log that provides access to the current version of each specification.
   v. Provides ability to link specifications to submittals and view the specification from the submittal.

p. Submittals
   i. Provides ability to upload a submittal register of all expected submittals.
   ii. Provides ability to create multi-step approval workflows for submittals, with reminder notifications for the current assignee.
   iii. Provides the ability to upload any file type without size restrictions.
   iv. Provides an auto-generated submittal log.

3. TECHNOLOGY

a. Fully web based with mobile apps for Windows, iOS and Android phones.

b. Accessible without logging in through a virtual private network (VPN).

c. Works on the current version of Internet Explorer, Google Chrome, Mozilla firefox and Apple Safari browsers.

d. Can generate emails automatically, and all attachments are included in the emails via download links to avoid emails not being delivered due to size.

e. PDF output of forms such as RFIs, Submittals, Meetings, Change Orders, etc. are available and customizable.

4. TRAINING AND SUPPORT

    a. Procore has learning portal certifications and support available online.

5. PROCEDURES

    a. RFIs and Submittals
        i. The Contractor will be responsible for submitting all RFIs and Submittals through the software and assigning them to the appropriate parties.
        ii. WCSD / Architects / Engineers / Consultants etc. are responsible for posting all responses to these items via the software, including all relevant attachments.
        iii. The Contractor will distribute responses to all affected subcontractors and confirm agreement with the response by closing the item.

    b. Construction Documentation
        i. The Contractor will manage Drawings, Specifications and Documents in the software to ensure that the current version of all applicable construction documentation is available to the entire team via web and mobile.
        ii. The Contractor will ensure that all RFIs which modify the current drawings are posted to the drawings and available via web and mobile within 24 hours of the RFI being responded to.

    c. Contractor will record and distribute action items via the software.

    d. Contractor will take daily site photos and make them publicly available.

    e. Punchlist
        i. All punch list items will be managed through the software.
        ii. Punchlist items will be created by the Contractor while walking with the Owner and applicable consultants.

6. PRICING

    a. The cost of Procore Technologies services (software fee) has been paid in full by WCSD, but the contractor's bid shall include any costs the Contractor deems necessary to execute the use of Procore as identified above.

    b. Procore Replicator is an add-on service allowing Contractor and Owner accounts to mirror relevant program tools and folders. Procore Replicator may be utilized at Contractor's sole discretion and expense. Inclusion of Procore Replicator requires a data sharing agreement between Contractor and Owner. Procore Connect will also be required to allow document sharing between Owner and Contractor accounts.

END OF SECTION 01041

SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all contract documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for cutting and patching.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 1 SECTION 01040 - COORDINATION for procedures for coordinating cutting and patching with other construction activities.

2. Division 2 SELECTIVE DEMOLITION for demolition of selected portions of the building for alterations.

3. Refer to other sections for specific requirements and limitations applicable to cutting and patching individual parts of the work.

    a. Requirements of this section apply to mechanical and electrical installations. Refer to Division 15 and 16 sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Owner requires approval of these procedures before proceeding. Request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required. Show how it will be performed and indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.

3. List products to be used and firms or entities that will perform work.

4. Indicate dates when cutting and patching will be performed.

5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:

a. Foundation construction
b. Bearing and retaining walls
c. Structural steel
d. Lintels
e. Miscellaneous structural metals
f. Piping, ductwork, vessels, and equipment

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

a. Primary operational systems and equipment
b. Air or smoke barriers
c. Water, moisture or vapor barriers
d. Membranes and flashings
e. Fire protection systems
f. Noise and vibration control elements and systems
g. Control systems
h. Communication systems
i. Electrical wiring systems
j. Operating systems of special construction in Division 13 sections

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1. If possible, retain the original installer or fabricator to cut and patch the exposed work. If it is impossible to engage the original installer or fabricator, engage another recognized experienced and specialized firm.

1.5 WARRANTY

A. Existing Warranties: Replace, patch and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties, required or existing.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or a diamond-core drill.
4. Comply with requirements of applicable Division 2 sections where cutting and patching requires excavating and backfilling.

5. Where services are required to be removed, relocated or abandoned, bypass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.

4. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.4 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty and similar items. Thoroughly clean piping, conduit and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

SECTION 01110 – PREVAILING WAGE AND APPRENTICESHIP UTILIZATION SPECIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents, addendums and all NRS 338 Prevailing Wage and Apprenticeship Utilization Act requirements associated with this project shall apply to this section. Various forms and information can be found on the Office of the Labor Commisioner's website https://labor.nv.gov/

1.2 SUMMARY

A. This section includes administrative and procedural requirements for submittals required for performance of the work, including the following:

1. Contractor/Subcontractor Notification
2. Completion Notification
3. Weekly Wage and Hour Report of Public Works Contractors.
4. Weekly Wage and Hour Report submittal log.
5. Certification of bidder regarding penalties for noncompliance
6. Certification of bidder, proposed contractor or subcontractor regarding debarment, suspension, ineligibility of voluntary exclusion.

B. Related Sections: The following section(s) may contain requirements that relate to this section if included:

1. SECTION - 01027 APPLICATIONS FOR PAYMENT
2. SECTION – 01300 SUBMITTALS

1.3 SUBMITTAL PROCEDURES

A. Compensation:

1. No extension of contract time, overhead, or profit will be authorized because of failure to transmit any required submittals or payroll report submittals to the Owner sufficiently in advance of progress payment submittals.

2. No extension of contract time will be authorized because of failure to transmit or report of any forms.

B. Required Submittals

1. CONTRACTOR/SUBCONTRACTOR NOTIFICATION

a. The Apparent Low Bidder is requested to submit the information on the Comprehensive Contractor/Subcontractor List for the Prime Bidder and all named (used) Subcontractors whom they engage for work within two (2) business days after Recommendation of Award, which will be supplied by the Purchasing Department.

b. It shall be the Contractor's responsibility to comply and submit any required forms directly to the Office of the Labor Commissioner’s as required by NRS 338.

2. COMPLETION NOTIFICATION

The contractor shall notify Washoe County School District when completion of all work performed under the contract is complete.

3. WEEKLY WAGE AND HOUR REPORTING OF PUBLIC WORKS CONTRACTORS

a. The contractor and all subcontractors are required to submit Certified Weekly Wage and Hour Reports of Public Work Contractors for each weekly payroll to Washoe County School District through the use of LCP Tracker, a paperless online system for filling certified payroll. The first weekly report will begin on the Notice to Proceed date and conclude on the following Saturday. If the Notice to Proceed date falls on a Saturday, the first report will only include reporting for that day. All successive reports will begin on the following Sunday and conclude on the following Saturday. All subcontractor report numbers shall coincide with the General Contractors report numbers. If the contractor or subcontractors do not work during any weekly reporting period they still must submit a report

indicating no public work project hours were performed for that weekly period. When contract scope of work is completed including punch list work, the last report is to be clearly marked “FINAL REPORT.”

b. Weekly Wage and Hour Report of Public Works Contractors and Weekly Wage and Hour Report submittal log must be submitted into Washoe County School District LCP Tracker system within fifteen (15) calendar days following the end of the month being reported.

c. The Prime contractor is required to designate an individual as Prime Approver for the project. The Prime Approver will oversee the reporting for all subcontractors of all tiers on the project. WCSD will set up the Prime Approver Account for the project. Thereafter, the Prime Approver will have the responsibility to use the Account to approve all payroll on the project.

d. The prime contractor is required to assign subcontractors within the LCP Tracker system to the project and to ensure that all subcontractors are aware of the necessity to file payrolls electronically, are set up within the system and all required payrolls are filed by subcontractors of all tiers.

.

1.4 OWNER'S ACTION

A. The owner will review each submittal, mark to indicate action taken, and provide review and acceptance.

1. Compliance with submittal requirements is the Contractor’s responsibility.

1.5 POSTINGS/SIGNAGE

A. Each contractor engaged on a public work must post the applicable prevailing rate of wages for the project on the site of the public work in a generally visible place to workmen.

B. Each contractor engaged in a public work must provide a sign with a white background and 6" black lettering stating, "Posted prevailing wages apply to this public works project". This sign must be posted on the site of the public work in a generally visible place to workmen. This will be maintained by the Contractor throughout the construction phase from the Notice to Proceed date through completion of the project.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01110

WASHOE COUNTY SCHOOL DISTRICT

WEEKLY WAGE AND HOUR REPORT SUBMITTAL LOG

Report Number	Contractor	Week Ending Date	Date Submitted

Washoe County School District

WEEKLY WAGE AND HOUR REPORT OF PUBLIC WORK CONTRACTORS FOR THE PAYROLL PERIOD ENDING _____, _____

Month and Day Year

Pursuant to Chapter 338 of NRS and NAC, respectively, the contractor and each subcontractor shall keep or cause to be kept an accurate record showing the name and the actual per diem, wages and benefits paid to each workman employed by him in connection with the public work. The contractor or subcontractor shall ensure that a copy of the record for each calendar month is received by the public body awarding the contract no later than 15 days after the end of the month.

Report # ☐ Regular Weekly Report ☐ . Final Report Bid/Project # PWP-

Project Title Public Body Awarding Contract **Washoe County School District**

Prime Contractor Name & Address License #

Subcontractor Name & Address License #

Employee Name & State/Jurisdiction that Issued Identification	Work Classification		Hours Worked By Day							Total Hours For Week	Hourly Rate Of Pay including fringe	Hourly Fringe Benefit Contribution					Gross Amount Earned For Week	Net Wage Paid For Week
			S	M	T	W	T	F	S			H & W	Pen.	Vac.	App. Trg	Other		
		S								0								
		O								0								
		S								0								
		O								0								

Report Hours For Above Referenced Public Works Project Only

Employee Name & State/Jurisdiction that Issued Identification	Work Classification	Hours Worked By Day								Total Hours For Week	Hourly Rate Of Pay including fringe	Hourly Fringe Benefit Contribution					Gross Amount Earned For Week	Net Wage Paid For Week
			S	M	T	W	T	F	S			H & W	Pen.	Vac.	App. Trg	Other		
			1/0	1/0	1/0	1/0	1/0	1/0	1/0									
		S								0								
		O								0								
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		O								0								
		S								0								
		O								0								

Report Hours For Above Referenced Public Works Project Only

Employee Name & State/Jurisdiction that Issued Identification	Work Classification	Hours Worked By Day								Total Hours For Week	Hourly Rate Of Pay including fringe	Hourly Fringe Benefit Contribution					Gross Amount Earned For Week	Net Wage Paid For Week
			S	M	T	W	T	F	S			H & W	Pen.	Vac.	App. Trg	Other		
			1/0	1/0	1/0	1/0	1/0	1/0	1/0									
		S								0								
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Report Hours For Above Referenced Public Works Project Only

Employee Name & State/Jurisdiction that Issued Identification	Work Classification	Hours Worked By Day								Total Hours For Week	Hourly Rate Of Pay including fringe	Hourly Fringe Benefit Contribution					Gross Amount Earned For Week	Net Wage Paid For Week
			S	M	T	W	T	F	S			H & W	Pen.	Vac.	App. Trg	Other		
			1/0	1/0	1/0	1/0	1/0	1/0	1/0									
		S								0								
		O								0								
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Report Hours For Above Referenced Public Works Project Only

Employee Name & State/Jurisdiction that Issued Identification	Work Classification	Hours Worked By Day								Total Hours For Week	Hourly Rate Of Pay including fringe	Hourly Fringe Benefit Contribution					Gross Amount Earned For Week	Net Wage Paid For Week
			S	M	T	W	T	F	S			H & W	Pen.	Vac.	App. Trg	Other		
			1/0	1/0	1/0	1/0	1/0	1/0	1/0									
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Report Hours For Above Referenced Public Works Project Only

Employee Name & State/Jurisdiction that Issued Identification	Work Classification	Hours Worked By Day								Total Hours For Week	Hourly Rate Of Pay including fringe	Hourly Fringe Benefit Contribution					Gross Amount Earned For Week	Net Wage Paid For Week
			S	M	T	W	T	F	S			H & W	Pen.	Vac.	App. Trg	Other		
			1/0	1/0	1/0	1/0	1/0	1/0	1/0									
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Report Hours For Above Referenced Public Works Project Only

STATE OF NEVADA
Office of the Labor Commissioner
STATEMENT OF COMPLIANCE

In compliance with the provisions of Chapters 338 of NRS and NAC, respectively, I, as an officer, owner or director of the undersigned contractor, hereby certify that this report is a true and accurate statement of worker's earnings employed on this Public Works contract by the undersigned contractor for the following payroll period:

_____ , _____ to _____ , _____ .
Month and Day Year Month and Day Year

I further certify:

1. That no deductions have been made from the wages earned by any person so listed other than those permissible or required by law.
2. That any apprentice listed herein is registered in a bona fide apprenticeship program.
3. Check all that apply:

☐ The contractor is signatory to a collective bargaining agreement with some or all of its employees.
☐ Each employee listed has been paid the required applicable wages plus the amount of fringe benefits listed in their contract.
☐ Each employee listed has been paid the required applicable wages per hour with no fringe benefit contributions paid by the contractor.

☐ Prime Contractor
☐ Subcontractor

Contractor Name:	Address:
Telephone:	Fax:

_____ _____ _____
Printed Name / Title Signature Date

NRS 338.070:

4. The contractor and each subcontractor shall keep or cause to be kept an accurate record showing the name and the actual per diem, wages and benefits paid to each workman employed by him in connection with the public work.

5. The record must be open at all reasonable hours to the inspection of the public body awarding the contract, and its officers and agents. The contractor or subcontractor shall ensure that a copy of the record for each calendar month is received by the public body awarding the contract no later than 15 days after the end of the month. The copy must be open to public inspection as provided in NRS 239.010. The record in the possession of the public body awarding the contract may be discarded by the public body 2 years after final payment is made by the public body for the public work.

6. Any contractor or subcontractor, or agent or representative thereof, performing work for a public work who neglects to comply with the provisions of this section is guilty of a misdemeanor.



NON-PERFORMANCE PAYROLL REPORT FOR PUBLIC WORKS PROJECTS

Pursuant to Chapter 338 of NRS and NAC, respectively, the contractor and each subcontractor shall keep or cause to be kept an accurate record showing the name and the actual per diem, wages and benefits paid to each workman employed by him in connection with the public work. The contractor or subcontractor shall ensure that a copy of the record for each calendar month is received by the public body awarding the contract no later than 15 days after the end of the month.

Report # _____ ☐ Regular Weekly Report ☐ . Final Report Bid/Project # _____ PWP- _____

Project Title _____ Public Body Awarding Contract **WASHOE COUNTY SCHOOL DISTRICT**

Prime Contractor Name & Address _____ License # _____

Subcontractor Name & Address _____ License # _____

Payroll period _____, _____ to _____ _____

Month and Day Year Month and Day Year

I hereby certify that no employees or owner/operators were used on the construction of this Public Works project during the payroll period above.

_____ _____ _____

Name & Title (please print) Signature Date

STATE OF NEVADA

JOE LOMBARDO
GOVERNOR

DR. KRISTOPHER SANCHEZ
DIRECTOR

BRETT K. HARRIS, ESQ.
LABOR COMMISSIONER



OFFICE OF THE LABOR COMMISSIONER
3340 WEST SAHARA AVENUE
LAS VEGAS, NV 89102
PHONE: (702) 486-2650
FAX (702) 486-2660
OFFICE OF THE LABOR COMMISSIONER
1818 COLLEGE PARKWAY, SUITE 102
CARSON CITY, NV 89706
PHONE: (775) 684-1890
FAX (775) 687-6409
EMAIL: PUBLICWORKS@LABOR.NV.GOV

2027 PREVAILING WAGE RATES
WASHOE COUNTY REGION

DATE OF DETERMINATION: October 1, 2026

RATES ARE SUBJECT TO CHANGE UP UNTIL OCTOBER 1, 2026

THIS SOFT POST IS AN OPPORTUNITY TO ALLOW YOU TO REVIEW RATES PRIOR TO OCTOBER 1, 2026

APPLICABLE FOR PUBLIC WORKS PROJECTS OVER $100,000 BID/AWARDED
OCTOBER 1, 2026, THROUGH SEPTEMBER 30, 2027

PREVAILING WAGE DETERMINATIONS - NRS 338.030(7), the wages so determined must be:

(a) Issued by the Labor Commissioner on October 1 of the odd-numbered year in which the survey was conducted and, except as otherwise provided in subsection 8, remain effective for 2 years after that date; and (b) Made available by the Labor Commissioner to any public body which awards a contract for any public work.

Pursuant to NRS 338.025, for determining the prevailing rate of wages pursuant to NRS 338.030, four prevailing wage regions are hereby established in this State as follows:

1. The Washoe Prevailing Wage Region consisting of Washoe County;
2. The Northern Rural Prevailing Wage Region consisting of Carson City and the counties of Churchill, Douglas, Elko, Eureka, Humboldt, Lander, Lyon, Mineral, Storey, Pershing and White Pine;
3. The Clark Prevailing Wage Region consisting of Clark County, and
4. The Southern Rural Prevailing Wage Region consisting of the counties of Esmeralda, Lincoln and Nye.

OBJECTIONS TO PREVAILING WAGE DETERMINATIONS – NRS 338.030(2): Objections to Prevailing Wage Determinations must be submitted within 30 days after the Prevailing Wage Determinations are issued.

Pursuant to NRS 338.030(8), the Labor Commissioner will review the prevailing wage rates in each even-numbered year to determine if adjustments should be made.

Pursuant to Nevada Revised Statutes (NRS) 338.030(9)(a), "If the contract for a public work: (a) Is to be awarded pursuant to a competitive bidding process, the prevailing wages in effect at the time of the opening of the bids for a contract for a public work must be paid until the completion or termination of the contract or for the 36 months immediately following the date on which the bids were opened, whichever is earlier." For contracts not awarded pursuant to competitive bidding, please see NRS 338.030(9)(b). However, if a project exceeds 36 months new wage rates may apply pursuant to NRS section 338.030(9)(10). Prevailing Wage Rates may be adjusted based on Collective Bargaining Agreements (CBA's) and adjustments to those agreements. (See NRS 338.030)

As Amendments/Revisions are made to the wage rates, they will be posted within the corresponding region's prevailing wage determination and updated with the applicable amendment number.

AIR BALANCE TECHNICIAN 4
ALARM INSTALLER 5
BOILERMAKER 6
BRICKLAYER 7
CARPENTER 9
CEMENT MASON 11
ELECTRICIAN - COMMUNICATION TECHNICIAN 12
ELECTRICIAN - LINEMAN/GROUNDMAN/HEAVY EQUIPMENT OPERATOR 13
ELECTRICIAN - NEON SIGN 14
ELECTRICIAN - WIREMAN 15
ELEVATOR CONSTRUCTOR 16
FENCE ERECTOR 18
FLAG PERSON 19
FLOOR COVERER 20
GLAZIER 21
HIGHWAY STRIPER 22
HOD CARRIER-BRICK MASON TENDER 23
HOD CARRIER-PLASTERER TENDER 24
IRONWORKER 26
LABORER 29
LUBRICATION AND SERVICE ENGINEER (EQUIPMENT GREASER MOBILE AND GREASE RACK) 30
MECHANICAL INSULATOR 31
MILLWRIGHT 32
OPERATING ENGINEER 35
OPERATING ENGINEER - STEEL FABRICATOR & ERECTOR 35
OPERATING ENGINEER - PILE DRIVER 36
PAINTER 38
PILE DRIVER 40
PLASTERER 41
PLUMBER/PIPEFITTER 42
REFRIGERATION MECHANIC 43
ROOFER 44
SHEET METAL WORKERS 46
SOILS and MATERIAL TESTER 47
SPRINKLER FITTER 48
SURVEYOR 49
TAPER 50
TILE SETTER/TERRAZZO WORKER/MARBLE MASON FINISHER 52
TILE SETTER/TERRAZZO WORKER/MARBLE MASON 53
TRAFFIC BARRIER ERECTOR 54
TRUCK DRIVER 55
WELL DRILLER 56

GROUP CLASSIFICATIONS 57
LABORER 57
OPERATING ENGINEER 60

NRS 338.010(25) "Wages" means:

a) The basic hourly rate of pay; and
b) The amount of pension, health and welfare, vacation and holiday pay, the cost of apprenticeship training or other similar programs or other bona fide fringe benefits which are a benefit to the worker.

Pursuant to NRS 338.010(26) & NRS 338.020(3), overtime is calculated on the Prevailing Wage Rate (Base + Fringe) unless otherwise noted below in the premium pay section for *each* craft.

NRS 338.035 Bona Fide Fringe Benefits - Discharge of part of obligation of contractor or subcontractor engaged on public work to pay wages by making certain contributions in name of workman. "Bona fide fringe benefit" means a benefit in the form of a contribution that is made not less frequently than monthly to an independent third party pursuant to a fund, plan or program: (a) Which is established for the sole and exclusive benefit of a worker and his or her family and dependents; and (b) For which none of the assets will revert to, or otherwise be credited to, any contributing employer or sponsor of the fund, plan or program. The term includes, without limitation, benefits for a worker that are determined pursuant to a collective bargaining agreement and included in the determination of the prevailing wage by the Labor Commissioner pursuant to NRS 338.030.

Please see NRS 338.010, 338.020, and 338.035 and Nevada Administrative Code (NAC) 338.0097 and 338.092 through 338.100 for further details on "bona fide fringe benefits," reporting requirements, and exceptions.

Job Descriptions for Recognized Classes of Workers

Regarding job descriptions for public works projects, please take notice of the following:

1. The job description links have been redacted to include ONLY the scope of work for the craft.
2. Pursuant to NAC 338.0095(1)(a): A worker employed on a public work must be paid the applicable prevailing rate of wage for the type of work that the worker actually performs on the public work and in accordance with the recognized class of the worker.
3. The work description for a particular class is not intended to be jurisdictional in scope.
4. Any person who believes that a type of work is not classified, or who otherwise needs clarification pertaining to the recognized classes or job descriptions, shall contact the Labor Commissioner in writing for a determination of the applicable classification and pay rate for a particular type of work.
5. The job descriptions set forth or referenced herein supersede any, and all descriptions previously agreed upon by the Labor Commissioner in any settlement agreements or stipulations arising out of contested matters.
6. The following specific provisions, where applicable, shall prevail over any general provisions of the job descriptions:

    - Amendments to the prevailing wage determinations.
    - Group Classifications and/or descriptions recognized by the Labor Commissioner and included with wage determinations for a particular type of work in a particular county.

Zone Rates

The zone rate has been added to each applicable craft.

Premium Pay Premium pay for hours worked in excess of a shift of 8 hours or 12 hours, or such other time increment set forth in the Collective Bargaining Agreement or on a weekend or holiday.

Craft: AIR BALANCE TECHNICIAN (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Air Balance Technician Journeyman	$96.37
Air Balance Technician-Foreman	$103.20
Air Balance Technician-General Foreman	$110.03

ADD ZONE RATE:

In addition to AIR BALANCE TECHNICIAN add the applicable amounts per hour, rates calculated on one-way drive miles using Google Maps based on shortest distances from the courthouse in Reno, Nevada:

Zone 1	0 to 29 miles	$0.00
Zone 2	30 to 49 miles	$3.00
Zone 3	50 to 100 miles	$6.00
Zone 4	Over 100 miles	$9.00

ADD PREMIUM PAY:

All work performed outside the regular working hours and performed during the regular workweek shall be at one and one-half (1.5) times the straight time rate of pay. Sundays and Holidays shall be paid at double (2x) the straight time rate of pay. When employees work more than sixty (60) hours in a work week, it will be paid at double (2x) time. Double (2x) the straight time rate of pay shall be paid when employees report back to work without an eight (8) hour rest period between shifts.

General Foreman, Foreman, and Stewards who maintain current First Aid/CPR Completion Certificates shall receive an additional Fifty Cents ($0.50) over their base wage.

REGULAR WORKING HOURS: Eight (8) hours between 6:00 am and 4:30 pm, except for the months of May 15 through September 15, in which 5:00 am may be the start time. Other start times must be approved.

WORKWEEK: Five (5) consecutive eight (8) hour days, beginning on Monday and ending with Friday of each week.

****Overtime and Double Time are calculated on the base rate of pay.**

SHIFT DIFFERENTIAL (Not less than five (5) full consecutive days Monday through Friday):

Second shift (Swing)	4:00 p.m. to 11:30 p.m.	10% per hour increase and eight (8) hours' pay for seven and one-half (7 ½) hours worked
Third shift (Graveyard)	12:01 a.m. to 7:00 a.m.	15% per hour increase and eight (8) hours' pay for seven (7) hours worked

**If the second shift extends past midnight, the entire second shift shall be paid at the graveyard shift rate. No shift overlap, and shift changes will be permitted on Monday.*

RECOGNIZED HOLIDAYS:

New Year's Day	Presidents' Day	Memorial Day	Independence Day
Labor Day	Veterans Day	Thanksgiving Day	Friday following Thanksgiving Day
Christmas Eve Day	Christmas Day	Days locally observed as such	

**If a holiday falls on Saturday, the Friday preceding shall be a recognized holiday. If a holiday falls on Sunday, the Monday following shall be a recognized holiday.*

JOB DESCRIPTION:

Excerpt from Sheet Metal Local 88 Collective Bargaining Agreement.

Manufacture, fabrication, assembling, handling, erection, installation, dismantling, conditioning, adjustment, alteration, repairing and servicing of all ferrous or nonferrous metal work and all other materials used in lieu thereof and of all HVAC systems, air veyor systems, exhaust systems, and air-handling systems regardless of material used including the setting of all equipment and all reinforcements in connection therewith; all lagging over insulation and all duct lining; testing and balancing of all air-handling equipment and duct work; the preparation of all shop and field sketches whether manually drawn or computer assisted used in fabrication and erection, including those taken from original architectural and engineering drawings or sketches; metal exterior wall systems, and metal roofing.

Craft: ALARM INSTALLER (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Alarm Installer	$43.43

JOB DESCRIPTION (Copied from O*NET OnLine):

Includes but is not limited to:

- Install, maintain, or repair security systems, alarm devices, or related equipment, following blueprints of electrical layouts and building plans.
- Mount and fasten control panels, door and window contacts, sensors, or video cameras, and attach electrical and telephone wiring to connect components.
- Demonstrate systems for customers and explain details, such as the causes and consequences of false alarms.
- Test and repair circuits and sensors, following wiring and system specifications.

Craft: BOILERMAKER (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Boilermaker	$79.07

JOB DESCRIPTION (Copied from O*NET OnLine):

Includes but is not limited to:

Construct, assemble, maintain, and repair stationary steam boilers and boiler house auxiliaries. Align structures or plate sections to assemble boiler frame tanks or vats, following blueprints. Work involves use of hand and power tools, plumb bobs, levels, wedges, dogs, or turnbuckles. Assist in testing assembled vessels. Direct cleaning of boilers and boiler furnaces. Inspect and repair boiler fittings, such as safety valves, regulators, automatic-control mechanisms, water columns, and auxiliary machines.

Sample of reported job titles: Boiler Installer, Boiler Mechanic, Boiler Repairman, Boiler Service Technician (Boiler Service Tech), Boiler Technician (Boiler Tech), Boilermaker, Boilermaker Mechanic, Boilermaker Pipe Fitter, Boilermaker Welder, Industrial Boiler Service Technician (Industrial Boiler Service Tech).

- Conduct pressure tests on vessels, such as boilers.
- Study blueprints to determine locations, relationships, or dimensions of parts.
- Examine boilers, pressure vessels, tanks, or vats to locate defects, such as leaks, weak spots, or defective sections, so that they can be repaired.
- Inspect assembled vessels or individual components, such as tubes, fittings, valves, controls, or auxiliary mechanisms, to locate any defects.
- Lay out plate, sheet steel, or other heavy metal and locate and mark bending and cutting lines, using protractors, compasses, and drawing instruments or templates.
- Bell, bead with power hammers, or weld pressure vessel tube ends to ensure leakproof joints.
- Locate and mark reference points for columns or plates on boiler foundations, following blueprints and using straightedges, squares, transits, or measuring instruments.
- Shape or fabricate parts, such as stacks, uptakes, or chutes, to adapt pressure vessels, heat exchangers, or piping to premises, using heavy-metalworking machines such as brakes, rolls, or drill presses.
- Position, align, and secure structural parts or related assemblies to boiler frames, tanks, or vats of pressure vessels, following blueprints.
- Clean pressure vessel equipment, using scrapers, wire brushes, and cleaning solvents.
- Repair or replace defective pressure vessel parts, such as safety valves or regulators, using torches, jacks, caulking hammers, power saws, threading dies, welding equipment, or metalworking machinery.
- Attach rigging and signal crane or hoist operators to lift heavy frame and plate sections or other parts into place.
- Straighten or reshape bent pressure vessel plates or structure parts, using hammers, jacks, or torches.
- Shape seams, joints, or irregular edges of pressure vessel sections or structural parts to attain specified fit of parts, using cutting torches, hammers, files, or metalworking machines.
- Bolt or arc weld pressure vessel structures and parts together, using wrenches or welding equipment.
- Install manholes, handholes, taps, tubes, valves, gauges, or feedwater connections in drums of water tube boilers, using hand tools.
- Assemble large vessels in an on-site fabrication shop prior to installation to ensure proper fit.
- Install refractory bricks or other heat-resistant materials in fireboxes of pressure vessels.

Craft: BRICKLAYER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Bricklayer Journeyman	$64.38
Bricklayer Foreman-10 persons	$65.38
Bricklayer Foreman-11-20 persons	$66.38
Bricklayer Foreman- 21-40 persons	$67.38
Bricklayer Foreman-41 or more persons	$68.38
Bricklayer General Foreman	$69.38

ZONE PAY:

Expense payments per day for travel to and from projects located thirty-five (35) or more road miles from the Washoe County Courthouse in Reno:

Zone 1	0 – 34 Road Miles	Free Zone
Zone 2	35 – 75 Road Miles	$50.00 per day, seven days a week
Zone 3	Over 75 Road Miles	$80.00 per day

***Eighty-five dollars ($85.00) subsistence per day, seven days per week, for the duration of the employee's participation on the job and IRS mileage reimbursement rate per road mile traveled in own transportation.*

ADD PREMIUM PAY:

Employees will be paid one and one-half (1.5) times the hourly wage rate for all hours worked over eight (8) in a single day, and double time (2x) after ten (10) hours in a single day. The first ten (10) hours performed on Saturday (regardless of whether the Employer has already made forty (40) hours of work available during the preceding work week) shall be at one and one-half (1.5) times the straight time rate, and all work performed thereafter shall be paid at double (2x). Sundays and Holidays shall be paid at double (2x) the straight time of pay. If the employee did not work forty (40) straight time hours in the preceding week, that employee shall be paid at one and one-half (1.5) the hourly wage rate for that portion of the Sunday work required to reach forty (40).

Exceptions: The Saturday falls on a Union recognized holiday—all hours should be paid at double (2x); Where it was not possible to work Monday through Friday of the preceding work week due to weather conditions or a breakdown of a piece of major equipment on the jobsite then up to eight (8) hours of work on Saturday may be performed at the straight time wage rate; the employer and employee agree that the missed day (up to eight (8) hours of work) can be made up by working Saturday at the straight time rate, written notice must be provided to the Union and signed by the employee.

STANDARD WORKDAY: Eight (8) continuous hours of work between the hours of 5:30 a.m. and 4:30 p.m. Monday through Friday. The normal starting and quitting times may be changed by the Employer in accordance with job site requirements established by the general contractor and upon notice. However, the Employer's right to adjust starting and quitting times shall be subject to the additional shift rates set forth below.

****Overtime and Double Time shall be calculated on the base rate of pay.**

SHIFT DIFFERENTIAL:

First shift (Day)	Starting time between 5:30 a.m. and 10:00 a.m.	Standard hourly wage.
Second shift (Swing)	If two shifts are established, shall receive eight (8) hours at the basic straight time rate	Additional $0.50 per hour for each of those eight hours.
Third shift (Graveyard)	If three shifts are established, shall consist of seven (7) hours of continuous work, plus one half-hour unpaid lunch period midway through the shift.	Additional $3.25 for each of those seven (7) hours. Time worked in excess of seven (7) hours on the third shift shall be paid at one and one-half (1.5) the straight time rate.

RECOGNIZED HOLIDAYS:

New Year's Day	Presidents' Day	Memorial Day	Independence Day
Labor Day	Veterans Day	Thanksgiving Day	Friday following Thanksgiving Day
Christmas Day			

**Any holiday falling on a Sunday will be observed on the Monday following, and any holiday falling on a Saturday will be observed on the preceding Friday.*

JOB DESCRIPTION:

Excerpt from Bricklayer and Allied Craftworkers Local Union No. 13 Collective Bargaining Agreement.

Brick Masonry shall consist of, but not be limited to, the following work procedures and installation of the following materials:

The laying of brick made from any material in, under or upon any structure or form of work where bricks are used, whether in the ground, or over its surface, or beneath water; in commercial and residential buildings, rolling mills, iron works, blast or smelter furnaces, lime or brick kilns; in mines or fortifications, and in all underground work, such as sewers, telegraph, electric and telephone conduits; including the installation of substitutes for brick such as all carbon materials, Karbate, Impervite or mixtures, all acid resistant materials, all terra cotta and porcelain materials, except where the foregoing materials are manufactured to substitute for tile as provided for under the category of Section 8, C, of this Code.
All cutting of joints, pointing, cleaning and cutting of brick walls, fireproofing, blockarching, terra cotta cutting and setting, the laying and cutting of all tile plaster, mineral-wool, cork blocks and glass masonry, or any substitute for above materials, the laying of all pipe sewers or water mains and the filling of all joints on the same when such sewers or conduits are of any vitreous material, burnt clay or cement, or any substitute material used for the above purpose, the cutting, rubbing and grinding of all kinds of brick and the setting of all cut stone trimmings on brick buildings, and the preparation and erection of plastic, castables or any refractory materials.

Cleaning, grouting, pointing, and other work necessary to achieve and complete the work under the foregoing categories; all waterproofing and black mastic waterproofing, silicone and/or substitutes sandwiched between masonry units in the interior of the wall.

All terra cotta called unit tile in sizes over 6"x12" regardless of method of installation; all quarry tile over 9"x9"x1 1/4" in size; split brick or quarry tile or similar material if bedded and jointed with one operation. The bedding, jointing, and pointing of the above materials shall be the work of the craft installing same.

All burnt clay extruded cellular products regardless of trade name or method of installation when used as a veneer on structures; all clay products known as terra cotta tile, unit tile, ceramic veneer and machine-made terra cotta and like materials in sizes larger than 6"x12", regardless of the method of installation. Where the preponderance of material to be installed is of the above size, and when material of lesser sizes is to be used in connection therewith, the bricklayers shall install all such materials. Brick paving comes under bricklayers' trade classification.

The preparation, setup, calibration, operation, cleaning, and routine maintenance of any mechanical devices or robotics used to install masonry units and materials, or that otherwise assist the mason in performing any of the work described in Article II and Code 1 of the IU Constitution, as well as the preparation and ongoing maintenance of the work area to allow proper installation of masonry units and materials.

Craft: CARPENTER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Carpenter Journeyman	$68.42
Carpenter Foreman	$72.73
Carpenter General Foreman	$77.47

**No employee shall have a primary work assignment of layout without receiving the foreman wage scale.*

ADD ZONE RATE:

In addition to CARPENTER rates, add the applicable amounts per hour, calculated from the Washoe County Courthouse:

Zone 1	Within 75 road miles	$0.00
Zone 2	Between 75 to 150 road miles	$6.00
Zone 3	Between 150 to 300 road miles	$7.00
Zone 4	In excess of 300 road miles	$8.00

**Workers performing outside of the free zones shall receive the appropriate remote area allowance for not less than eight (8) hours per day. Remote area differential shall be considered part of the basic wage rate for the purpose of computing overtime hourly wage rates. When the contractor furnishes daily transportation to the workers from Reno or Carson City to and from the jobsite, no travel time, subsistence, or remote area shall be paid. The workers will travel one way during regular working hours and one way outside of regular.*

ADD PREMIUM PAY:

Any work performed over eight (8) hours per day and on Saturdays shall be compensated at one and one-half (1.5) the appropriate hourly rate. All work performed on Sundays, holidays, and over twelve (12) hours in one (1) day shall be paid at two times (2x) the appropriate hourly rate.

REGULAR CONSTITUTED SHIFT: Eight (8) consecutive hours, exclusive of the meal period, between the hours of 5:30 a.m. and 5:00 p.m. Monday through Friday. An earlier start time must be arranged.

****Overtime and Double Time are paid on the total Taxable Wage (base rate).**

SHIFT DIFFERENTIAL:

Two Shifts	When shift work is performed, it must continue for a period of not less than five (5) consecutive workdays. When two (2) shifts are employed, both shifts shall work eight (8) hours at the regular straight time rate or a proportionate part thereof for the time worked. In two (2) shift operations, the first shift shall have a regular starting time not earlier than 5:00 a.m. and not later than 8:00 a.m., unless modified by mutual agreement of the Union and Employer.
Three Shifts First shift (Day)	When three (3) shifts are employed for five (5) or more consecutive days, the first shift shall be eight (8) consecutive hours (exclusive of meal period). The first shift shall start at 8:00 a.m.
Second Shift (Swing)	The second shift shall be seven and one-half (7½) hours. All shifts shall be compensated at eight (8) times the straight time hourly rate (exclusive of meal period). Shifts shall run consecutively for five (5) days or more
Third Shift (Graveyard)	The third shift shall be seven (7) hours. All shifts shall be compensated at eight (8) times the straight time hourly rate (exclusive of meal period). Shifts shall run consecutively for five (5) days or more

**In no event shall the regular working hours of different shifts overlap, and any interval between shifts shall not exceed one (1) hour.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Admission Day	Thanksgiving Day	Friday after Thanksgiving	Christmas Day

**Holidays falling on Sundays shall be observed on the following Monday; holidays falling on Saturdays shall be observed on the prior Friday. No work shall be performed on Labor Day, except to preserve life and property.*

JOB DESCRIPTION:

Excerpt from Wall and Ceiling Alliance and Western States Regional Council of Carpenters and Affiliated Local Unions Northern Nevada Master Labor Agreement.

1) All building construction, including but not limited to the construction, erection, alteration, repair, modification, demolition, addition, or improvement in whole or in part of any building structure. All rigging of Carpenters, and Piledrivers' materials.

(2) All heavy, highway and engineering construction, including but not limited to the construction, improvement, modification and demolition of all or any part of the streets, highways, bridges, viaducts, railroads, tunnels, airports, water supply, irrigation, flood control and draining systems, sewers and sanitation projects, dams, power houses, refineries, aqueducts, canals, river and harbor projects, wharves, docks, breakwaters, jetties, quarrying of breakwaters or rip rap stone or operations incidental to such heavy construction work and whether such work is above or below the water line level.

(3) Work shall include but not be limited to all carpenter, concrete form work, mass timber, shoring, drywall, metal stud, drywall finishing, floor treatments, plaster, scaffold, modular furniture, trade show work, insulation, firestop, acoustical, metal frames, including siding attached thereto, architectural metal and decorative metal panels, shingles, roofing, and plastics used in the performance of carpentry work, operation of the Pettibone and forklift incidental to carpentry work, stocking, scrapping and transportation of all carpentry materials and lathing work on such construction, including but not limited to plastics and such work in connection with new methods of construction or use of materials.

(4) All interior and/or exterior wall finish work, including EIFS and other wet wall finish work.

Craft: CEMENT MASON (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Cement Mason - Journeyman	$60.92
Cement Mason - Foreman	$65.42
Cement Mason – General Foreman	$67.42

ADD ZONE RATE:

In addition to CEMENT MASON rates, add the applicable amounts per hour, calculated from the Washoe County Courthouse:

Zone 1	0 to 75 miles	$0.00
Zone 2	76 to 150 miles	$6.00
Zone 3	151 to 300 miles	$7.00
Zone 4	Over 300 miles	$8.00

ADD PREMIUM PAY:

Any work performed over eight (8) hours per day shall be compensated at time and one-half (1.5x) the appropriate hourly rate. All work performed after twelve (12) consecutive hours shall be paid at double (2x) the appropriate rate. All work performed on Saturdays shall be compensated at time and one-half (1.5x) the appropriate hourly rate. All Sunday and Holiday work shall be paid for at double time (2x).

****Overtime and Double Time shall be calculated from the base rate of pay.**

ADDITIONAL PREMIUM PAY:

Mastic Magnesite & All Composition Masons	$0.25 per hour

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Admission (Nevada) Day	Thanksgiving Day	Family Day	Christmas

**Holidays falling on Sundays shall be observed on the following Monday.*

JOB DESCRIPTIONS:

Excerpt from Operative Plasterers' and Cement Masons' Northern Nevada OP&CMIA Local 797 Master Labor Agreement.

(a) All building construction, including but not limited to the construction, erection, alteration, repair, modification, demolition, addition or improvement in whole or part of any building structure.

(b) All heavy highway and engineering construction, including but not limited to the construction, improvement modifications and demolition of all or part of any streets and highways (including sidewalks, curbs and gutters,) bridges, viaducts, railroads, tunnels, airports, water supply, irrigation, flood control and drainage systems, sewer and sanitation projects, wharves, docks, breakwaters or rip-rap stone, or operation incidental to such heavy construction work.

The work to be performed by Cement Masons shall include but not be limited to the following, when tools of the Cement Masons trade are used or required:

Setting screeds, screed pins, curb forms and curb and gutter forms, rodding, spreading and tamping concrete, hand application of curing compounds, applying topping (wet or dry) colors or grits; using Darby and push floats, hand troweling or hand floating; marking edging, brooming or brushing, using base cove or step tools; chipping, and stoning, patching or sacking; dry packing; spreading and finishing gypsum, operating mechanical finishers (concrete) such as Clary, Jackson, Bidwell Bridge Deck Paver or similar types; grinding machines; troweling machines, floating machines powered concrete saws; finishing of epoxy and resin materials, bush hammering and exposed finishes for architectural work. Operation of skill saw, chain saw, Laser Screed, Laser Level, Curb and Slipform machines, Epoxy Type Injection pumps, stamps or other means of texturing, any new devices, which are beneficial to the construction of or with concrete or related products.

Craft: ELECTRICIAN COMMUNICATION TECHNICIAN (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Electrician Communication Technician	$52.56

JOB DESCRIPTION (copied from O*NET OnLine):

ELECTRONIC COMMUNICATION TECHNICIAN, includes but is not limited to:

Install, set up, rearrange, or remove switching, distribution, routing, and dialing equipment used in central offices or headends. Service or repair telephone, cable television, Internet, and other communications equipment on customers' property. May install communications equipment or communications wiring in buildings.

- Demonstrate equipment to customers and explain its use, responding to any inquiries or complaints.
- Test circuits and components of malfunctioning telecommunications equipment to isolate sources of malfunctions, using test meters, circuit diagrams, polarity probes, and other hand tools.

- Test repaired, newly installed, or updated equipment to ensure that it functions properly and conforms to specifications, using test equipment and observation.
- Climb poles and ladders, use truck-mounted booms, and enter areas such as manholes and cable vaults to install, maintain, or inspect equipment.

- Assemble and install communication equipment such as data and telephone communication lines, wiring, switching equipment, wiring frames, power apparatus, computer systems, and networks.

Craft: ELECTRICIAN LINEMAN/GROUNDMAN/HEAVY EQUIPMENT OPERATOR (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Electrician-Groundman	$64.88
Lineman-Journeyman	$101.19
Lineman-Foreman	$109.44
Lineman-General Foreman	$117.81
Lineman-Equipment Man	$78.63

ADD PREMIUM PAY:

All work performed outside of the regular scheduled working hours and on Saturdays, Sundays, and holidays shall be paid at double (2x) the regular straight-time rate of pay.

WORKDAY & WORKWEEK: Eight (8) hours of work between 8:00 am and 4:30 pm. Monday through Friday.

***Overtime and Double Time are calculated on the straight-time hourly rate (base rate).**

SHIFT DIFFERENTIAL:

First shift (day shift)	8:00 am and 4:30 pm	regular hourly rate
Second shift (swing shift)	4:30 pm and 1:00 am	regular hourly rate plus 10%
Third shift (graveyard shift)	12:30 am and 8:00 am	regular hourly rate plus 15%

**There is no pyramiding of overtime rates, and double the straight rate is the maximum for any hour worked. There shall be no requirement for a day shift when either the second or third shift is worked.*

RECOGNIZED HOLIDAYS:

New Year's Day	Presidents' Day	Memorial Day	Fourth of July
Labor Day	Nevada Day	Thanksgiving Day	Friday following Thanksgiving
Christmas Day			

**Holidays falling on Saturdays and Sundays do not require the employer to observe those holidays on a Friday or Monday*

JOB DESCRIPTION:

Excerpt from Western Line Constructors Chapter of NECA and IBEW Local 1245

Outside, overhead and underground construction and maintenance work on electrical transmission lines, switch yards, substations and distribution systems which shall include: Pole line work (whether built of wood, metal or other material): the digging and back-filling of holes for poles or anchors (by hand or mechanical equipment): the loading or unloading, handling, sorting and moving of materials; the assembly or erection of all materials including the guying, stringing of conductors and fiber optics or other work necessary on through to the ultimate completion of such pole work.

Steel or metal structures used for the purpose of carrying electrical wire, conductors, or equipment (this includes transmission towers, outdoor substations, switch racks, or similar electrical structures); the moving of men, tools or equipment; the loading or unloading, handling, sorting and moving of materials; the assembly and erection of all materials used on the job site, including the assembly of the grillage and foundations, on through to the ultimate completion of such structures. Work covered shall include the grounding of all such structures except the bonding of stub-angle to rebar cage; the stringing and installation of wires, cables and insulators or other electrical equipment suspended from structure; also the handling and placing of transformers or O.C.B.'s and other related electrical equipment.

The moving of men, tools or equipment; the loading or unloading, handling, sorting and moving of materials; the assembly of all electrical materials on race-ways such as ducts. This shall also include CIC (cable in conduit), CC (coiliable conduit), the placing of fish wire, the pulling of cables or wires through such race ways, installing and making up of termination and the splicing of such conductors.

Craft: ELECTRICIAN – NEON SIGN (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Electrician Neon Sign Journeyman	$66.94

JOB DESCRIPTION (Copied from O*NET OnLine):

- Installing, servicing and repairing plastic, neon and illuminated signs;
- Ascending ladders or operating hydraulic or electric hoist to install, service, or examine sign to determine cause of malfunction;
- Wiring, rewiring or removing defective parts and installing new parts using electrician's tools;
- Removing sign or part of sign for repairs, such as structural fabrication, scroll repair, or transformer repair.

Craft: ELECTRICIAN WIREMAN (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Wireman	$83.81
Wireman-Cable Splicer	$91.61
Wireman Forman	$91.61
Wireman General Foreman	$96.81

ADD ZONE RATE:

In addition to ELECTRICIAN-WIREMAN rates, add the applicable amounts per hour, calculated from Washoe County Courthouse, Reno Nevada:

Zone 1	0 to 50 miles	$0.00
Zone 2	51 to 70 miles	$3.00
Zone 3	71 to 90 miles	$10.00
Zone 4	91 miles and over	$15.00

ADD PREMIUM PAY:

Overtime at the rate of one and one-half (1 1/2) times the regular straight time rate of pay will be paid on the first (2) hours of work before or after the regular workday. Saturday overtime is one and one-half (1.5) times the regular rate for the first eight (8) hours and two times (2x) the rate thereafter. Sundays and holidays shall be paid double (2) times the straight rate of pay. Double the straight time rate is the maximum rate paid; no pyramiding of overtime rates.

WORKDAY & WORKWEEK: Eight (8) consecutive hours between 6:00 am and 6:00 pm, Monday through Friday.

****Overtime and Double Time are calculated on the base rate of pay.**

SHIFT DIFFERENTIAL:

First shift (day shift)	Eight (8) consecutive hours worked between 8:00 am and 4:30 pm	Regular hourly rate
Second shift (swing shift)	Eight (8) consecutive hours worked between 4:30 pm and 1:00 am	Regular hourly rate plus 17.3% for all hours worked
Third shift (graveyard shift)	Eight (8) consecutive hours worked between 12:30 am and 9:00 am	Regular hourly rate plus 31.4% for all hours worked

**Any shift starting time may be varied by up to two (2) hours.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Fourth of July	Labor Day
Admission(Nevada) Day	Veterans Day	Thanksgiving Day	Friday after Thanksgiving Day
Christmas Day			

**Holidays falling on Saturday shall be observed on the previous Friday. Holidays falling on Sunday shall be observed on the following Monday.*

JOB DESCRIPTION:

Excerpt from Agreement between NECA and Local Union 401, IBEW.

All electrical construction, installation, or erection work including fabrication or prefabrication of boxes, brackets, bends and nipples and all electrical maintenance thereon including the final running tests. This shall include the installation and maintenance of temporary wiring and the installation of all electrical lighting, heat and power equipment, installation of all raceway systems, including underground conduits and all supports, underground utility conduits, photovoltaic power generation systems, wind power generation systems and geothermal power generating systems. Further all salvage of electrical work shall be included.

Craft: ELEVATOR CONSTRUCTOR (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Elevator Constructor-Journeyman Mechanic.	$135.37
Elevator Constructor-Journeyman Mechanic In Charge	$147.18

ADD ZONE RATE:

In addition to ELEVATOR CONSTRUCTOR rates, add the applicable amounts per day, calculated from Washoe County Courthouse, Reno Nevada:

Free Zone	0 to 12 miles	$0.00
Zone 1	12 to 17 miles	$31.77
Zone 2	17 to 22 miles	$63.54
Zone 3	22 to 27 miles	$95.31
Zone 4	27+ miles	$115.00

ADD PREMIUM PAY:

Work performed on Saturdays, Sundays, and before and after the regular working day Monday to Friday is to be paid at double (2x) the regular rate. Work done on holidays shall be paid at double (2x) the regular rate. When four (4) or more men, including the Elevator Constructor Mechanic-In-Charge, are employed on new construction or modernization jobs, the Elevator Constructor Mechanic-in-Charge of the job shall have his hourly rate increased 12-1/2% (12.5%) for all hours worked

WORKDAY & WORKWEEK: Eight (8) hours worked between 6:00 a.m. and 5:00 p.m. Monday through Friday.

****Overtime (2x) is calculated on the base rate of pay.**

SHIFT DIFFERENTIAL:

First shift (Day)	8:00 a.m. to 4:30 p.m.	Standard hourly rate
Second shift (Swing)	4:30 p.m. to 12:30 a.m.	7 1/2 hrs. for 8 hrs. pay & fringe plus 10%
Third shift (Graveyard)	12:30 a.m. to 8:00 a.m.	7 hrs. for 8 hrs. pay & fringe plus 15%

**Shift work shall not be permitted except in cases where at least two (2) shifts per day are established for at least five (5) or more consecutive days including Saturday, Sunday, or Holiday when worked.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Veterans Day	Thanksgiving Day	Family Day	Presidents' Day
Christmas Day			

**All recognized holidays are paid holidays. Holidays falling on Saturday shall be observed on the previous Friday. Holidays falling on Sunday shall be observed on the following Monday.*

JOB DESCRIPTION:

Excerpt from Agreement of International Union of Elevator Constructors Local 8.

The handling and unloading of all equipment coming under the jurisdiction of the Elevator Constructor, from the time such equipment arrives at or near the building site, shall be handled and unloaded by the Elevator Constructors. Mechanical equipment such as a forklift or truck mounted swing boom may be used by the Elevator Constructors. A derrick, crane or material hoist can be used under the supervision of Elevator Constructors to handle and unload the heavy material where unusual conditions are expected to exist prior to delivery of equipment at or near the building site in regard to handling and unloading of equipment in the primary or secondary jurisdiction of the local union, the Company shall contact the Local's Business Representative to make appropriate arrangements for the handling and unloading of such equipment. In areas outside the jurisdiction of the local union, the Company shall contact the Regional Director.

The erecting and assembling of all elevator equipment to wit: electric, hydraulic, steam, belt, dumbwaiters, residence elevators, parking garage elevators (such as Bowser, Pigeon Hole, or similar types of elevators), shuttles, compressed air and handpower, automatic people movers, monorails, airport shuttles and like-named devices used in the transportation of people for short distances of travel (less than 5 miles), as well as vertical reciprocating conveyor systems.

It is understood and agreed that the preassembly of all escalators, moving stairways and link belt carriers that may be done in the factory shall include the following:

Truss or truss sections with tracks, drive units, machines, handrail drive sheaves, drive chains, skirts on the incline sections but not curved sections, step chains and steps installed and permanently aligned.
Balustrade brackets may be shipped attached but not aligned.
Setting of all controllers and all wiring and conduit from the controller.

All other work on escalators, moving stairways and link belt carriers shall be performed in the field before or after the truss or truss sections are joined and/or hoisted and placed in permanent position. This includes any and all work not done in the factory. The erecting and assembly of all theater stage and curtain elevator equipment and guides and rigging thereto, organ consoles and orchestra elevators

All wiring, conduit, and raceways from main line feeder terminals on the controller to other elevator apparatus and operating circuits. Controllers are not to be shipped from the factory with extended wiring attached thereto.
The erecting of all guide rails.
The installation of all grating under the control of the Company. The installation of all counterweight screens, overhead work, either wood or iron, and all material used for mounting of elevator apparatus in machine room, overhead or below.
The drilling of overhead beams for attaching machines, sheaves, kick angles, and all other elevator equipment.
The setting of all templates.
All foundations, either of wood or metal, that should take the place of masonry.
The assembly of all cabs complete.
The installation of all indicators.
The erecting of all electrical or mechanical automatic or semi-automatic gates complete.
The hanging of all automatic or semi-automatic elevator hoistway doors, together with the installation of hangers and tracks.
The installation of all devices for opening and closing and locking of elevator car and hoistway doors and gates.
The drilling of doors for mounting of closing devices.
The drilling of angle supports for mounting of closing devices except one template hole.
The drilling of sills for sill trips.
The operating of temporary cars.
The setting of all elevator pressure open or pit tanks.
The setting of hydraulic power units (power units include: motor, pump, drive valve system, internal piping, muffler, internal wiring, controller and tank). Where power units arrive in parts, they shall be assembled at the job site. The wiring and piping to and between multiple hydraulic power units shall be performed at the job site.
All air cushions with the exception of those built of brick or those put together with hot rivets.
Landing door entrances.

Craft: FENCE ERECTOR (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Fence Erector (Laborer Group 3)	$56.53

ADD ZONE RATE:

In addition to FENCE ERECTOR, add the applicable amounts per hour, calculated based on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$6.00
Zone 3	150 to 300 miles	$7.00
Zone 4	300 miles or over	$8.00

**No remote area pay shall be paid within ten (10) miles of employee's permanent place of residence in the State of Nevada.*

ADD PREMIUM PAY:

One and one-half (1.5) the regular straight time hourly rate shall be paid for all time worked over eight (8) or ten (10) (if on 4/10 schedule) in one day and on Saturdays. Sundays, Holidays, and all hours worked over twelve (12) in one day are to be paid at double (2x) the regular straight time hourly rate.

WORKDAY & WORKWEEK: Single shift jobs are eight (8) consecutive hours with a starting time between 5:30 am and 8:00 am., Monday through Friday.

****Overtime and Double Time shall be calculated on the Taxable Wage (base rate).**

SHIFT DIFFERENTIAL:

Second (swing) and Third (graveyard) shifts	Shall be paid a 12.5% differential

**Upon approval the Employer may utilize multiple shifts for less than five (5) consecutive days, provided there is a legitimate business or bid specification requirement and the shift differential is paid.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Admission (Nevada) Day	Thanksgiving Day	Family Day	Christmas Day

**If any of these holidays fall on Sunday, the Monday following shall be considered a holiday.*

JOB DESCRIPTION:

Except from Laborers Local 169.

(SEE LABORERS GROUP 3)

Craft: FLAG PERSON (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Flag Person (Laborer Group 1A)	$55.41

ADD ZONE RATE:

In addition to FLAG PERSON, add the applicable amounts per hour, calculated based on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$6.00
Zone 3	150 to 300 miles	$7.00
Zone 4	300 miles or over	$8.00

**No remote area pay shall be paid within ten (10) miles of employee's permanent place of residence in the State of Nevada.*

ADD PREMIUM PAY:

One and one-half (1.5) the regular straight time hourly rate shall be paid for all time worked over eight (8) or ten (10) (if on 4/10 schedule) in one day and on Saturdays. Sundays, Holidays, and all hours worked over twelve (12) in one day are to be paid at double (2x) the regular straight time hourly rate.

WORKDAY & WORKWEEK: Single shift jobs are eight (8) consecutive hours with a starting time between 5:30 am and 8:00 am., Monday through Friday.

****Overtime and Double Time shall be calculated on the Taxable Wage (base rate).**

SHIFT DIFFERENTIAL:

Second (swing) and Third (graveyard) shifts	Shall be paid a 12.5% differential

**Upon approval the Employer may utilize multiple shifts for less than five (5) consecutive days, provided there is a legitimate business or bid specification requirement and the shift differential is paid.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Admission (Nevada) Day	Thanksgiving Day	Family Day	Christmas Day

**If any of these holidays fall on Sunday, the Monday following shall be considered a holiday.*

JOB DESCRIPTION:

Except from Laborers Local 169. Includes but is not limited to:

1. Directing movement of vehicular traffic through construction projects;
2. Distributing traffic control signs and markers along site in designated pattern;
3. Informing drivers of detour routes through construction sites;

(SEE LABORERS GROUP 1A)

Craft: FLOOR COVERER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Floor Coverer Journeyman	$68.04
Floor Coverer Foreman	$72.85

ADD ZONE RATE:

In addition to FLOOR COVERER rates, add the applicable amounts per day calculated based on road miles from the Washoe County Courthouse.

Zone 1	0 to 70 miles	$0.00
Zone 2	Over 70 miles	$75.00

**Excludes the City limits of Fallon and the Fallon NAS.*

ADD PREMIUM PAY:

One and one-half (1.5) times shall be paid after eight (8) hours of work in a single shift up to ten (10) hours. All work performed on Saturday up to eight (8) hours shall be paid at time and one-half (1.5). All work performed after ten (10) hours Monday – Friday, after eight (8) hours on Saturday, and all hours on Sundays and holidays is to be paid at double time (2x).

WORKDAY: Shall consist of eight (8) or ten (10) hours of work depending on the work week, between 6:00 a.m. and 6:00 p.m. with one half (1/2) hour for lunch to be given no later than five (5) hours after the beginning of the shift. Where, in any locality, existing traffic conditions, job conditions, or weather conditions render it desirable to start the day shift at an earlier hour, such starting time may be instituted by the Employer upon written notice

WORKWEEK: The regular workweek shall consist of five (5) eight (8) hour workdays, Monday through Friday or four (4) consecutive ten (10) hour workdays between Monday and Friday.

****Overtime & Double Time shall be calculated on the base rate of pay.**

SHIFT DIFFERENTIAL:

Work done between 6:00 p.m. and 6:00 a.m.	20% above base wage for all hours worked

**Shift Work shall only be considered when an employee works a regular eight (8) or ten (10) hour day, forty (40) hour week. It shall not be used in place of overtime.*

RECOGNIZED HOLIDAYS:

Memorial Day	New Year's Day	Independence Day	Labor Day
Admission(Nevada)Day	Thanksgiving Day	Family Day	Christmas Day

** In no case shall work be performed on Labor Day from midnight to midnight except to protect life, limb, and property. Holidays falling on Saturday will be observed on the preceding Friday, and holidays falling on Sunday will be observed on the following Monday.*

JOB DESCRIPTION:

Excerpt from Agreement between DC 16 and The Independent Flooring Contractors of Northern Nevada (Local 567):

-All work including and related to the installation of resilient floor, wall, and ceiling materials commonly referred to as carpet, linoleum, vinyl, rubber, cork, asphalt, vinyl composite mastipave, synthetic grass and it's derivatives which includes but is not limited to the operation, maintenance and repair of the following equipment when used in the installation and removal of artificial turf, underlayments and all it's derivatives (forklifts, air compressors and any attachments, skid steer, skip loader, utility cart/top dresser, and lay-mor ride on sweeper), prefinished hardwood, laminates, engineered wood, all applications of pre-finished and laminate floors, epoxy, urethane, plastics, metal, and all similar materials in sheet, tile or liquid form.
-Installation on floors, walls, ceilings, stairs, fixtures, furnishings, or exterior applications on structures, patios, pool perimeters, sport fields, area ways, all other like or similar applications, whether permanent or temporary.
-Measuring, cutting, fabrication, packaging, pickup, delivery and handling of materials and tools that are used by the floor covering industry.
-Preparatory removal of floor covering, wall covering, adhesive and underlayments. The sanding, patching, sealing and priming of the installation surface.
-Installation of lining felt, carpet, pad, underlayment compositions, leveling compounds or any material used as a base for the finished surface.
-Applications and fitting of fasteners, protective and decorative trim relating to the installation such as tackless, tape, nosing, top set or butt-to-base, cap, corner beads, edging, hinging and all other accessories and related sundries.
-Repair, finishing, coating, sculpturing, insets and such other processes relating to the industry.

Craft: GLAZIER (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Glazier Journeyman	$30.65

JOB DESCRIPTION (copied from O*NET OnLine):

- Install glass in windows, skylights, store fronts, and display cases, or on surfaces, such as building fronts, interior walls, ceilings, and tabletops.
- Read and interpret blueprints or specifications to determine size, shape, color, type, or thickness of glass, location of framing, installation procedures, or staging or scaffolding materials required.
- Determine plumb of walls or ceilings, using plumb lines and levels.
- Install pre-assembled metal or wood frameworks for windows or doors to be fitted with glass panels, using hand tools.
- Fabricate or install metal sashes or moldings for glass installation, using aluminum or steel framing.
- Operate cranes or hoists with suction cups to lift large, heavy pieces of glass.
- Set glass doors into frames and bolt metal hinges, handles, locks, or other hardware to attach doors to frames and walls.
- Cut, fit, install, repair, or replace glass or glass substitutes, such as plastic or aluminum, in building interiors or exteriors or in furniture or other products.
- Drive trucks to installation sites and unload mirrors, glass equipment, or tools.
- Load and arrange glass or mirrors onto delivery trucks, using suction cups or cranes to lift glass.
- Measure mirrors and dimensions of areas to be covered to determine work procedures.
- Cut and attach mounting strips, metal or wood moldings, rubber gaskets, or metal clips to surfaces in preparation for mirror installation.
- Pack spaces between moldings and glass with glazing compounds and trim excess material with glazing knives.
- Assemble, erect, or dismantle scaffolds, rigging, or hoisting equipment.
- Cut and remove broken glass prior to installing replacement glass.
- Secure mirrors in position, using mastic cement, putty, bolts, or screws.
- Measure and mark outlines or patterns on glass to indicate cutting lines.
- Grind or polish glass, smoothing edges when necessary.
- Fasten glass panes into wood sashes or frames with clips, points, or moldings, adding weather seals or putty around pane edges to seal joints.
- Score glass with cutters' wheels, breaking off excess glass by hand or with notched tools.
- Cut, assemble, fit, or attach metal-framed glass enclosures for showers, bathtubs, display cases, skylights, solariums, or other structures.
- Prepare glass for cutting by resting it on rack edges or against cutting tables and brushing thin layer of oil along cutting lines or dipping cutting tools in oil.
- Move furniture to clear work sites and cover floors or furnishings with drop cloths.
- Confer with customers to determine project requirements or to provide cost estimates.
- Select the type or color of glass or mirror according to specifications.
- Measure, cut, fit, and press anti-glare adhesive film to glass or spray glass with tinting solution to prevent light glare.
- Assemble and cement sections of stained glass together.
- Create patterns on glass by etching, sandblasting, or painting designs.

Craft: HIGHWAY STRIPER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Highway Striper (Laborer Group 5A)	$59.03
Highway Striper Foreman	$60.53

ADD ZONE RATE:

In addition to HIGHWAY STRIPER, add the applicable amounts per hour, calculated based on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$6.00
Zone 3	150 to 300 miles	$7.00
Zone 4	300 miles or over	$8.00

**No remote area pay shall be paid within ten (10) miles of employee's permanent place of residence in the State of Nevada.*

ADD PREMIUM PAY:

One and one-half (1.5) the regular straight time hourly rate shall be paid for all time worked over eight (8) or ten (10) (if on 4/10 schedule) in one day and on Saturdays. Sundays, Holidays, and all hours worked over twelve (12) in one day are to be paid at double (2x) the regular straight time hourly rate.

WORKDAY & WORKWEEK: Single shift jobs are eight (8) consecutive hours with a starting time between 5:30 am and 8:00 am., Monday through Friday.

****Overtime and Double Time shall be calculated on the Taxable Wage (base rate).**

SHIFT DIFFERENTIAL:

Second (swing) and Third (graveyard) shifts	Shall be paid a 12.5% differential

**Upon approval the Employer may utilize multiple shifts for less than five (5) consecutive days provided there is a legitimate business or bid specification requirement and the shift differential is paid.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Admission (Nevada) Day	Thanksgiving Day	Family Day	Christmas Day

**If any of these holidays fall on Sunday, the Monday following shall be considered a holiday.*

JOB DESCRIPTION:

Excerpt from Laborers Local 169 Master Labor Agreement. Includes but is not limited to:

1. Painting highways, streets and parking surfaces by using manually propelled or mechanically propelled machines, brushes, rollers or spray guns;
2. Installing any device or application of any material used in lieu of paint for traffic direction, including, without limitation, buttons, tapes, plastics, rumble bars and other similar materials;

(SEE LABORERS GROUP 5A)

Craft: HOD CARRIER-BRICK MASON TENDER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Hod Carrier-Brick Mason Tender Journeyman	$56.78
Hod Carrier-Brick Mason Tender Foreman	$57.18

ADD ZONE RATE:

In addition to HOD CARRIER-BRICK MASON TENDER rates, add the applicable amounts per mile and day, calculated based on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone Rate	75 miles and over	On all projects over seventy-five (75) road miles from the Washoe County Courthouse, an Employee shall be paid thirty-four cents ($0.34) per mile traveled to the jobsite and back to Reno, once up and once back on a continuous job, plus sixty-five dollars ($65.00) per day.

ADD PREMIUM PAY:

One and one-half (1.5) the regular straight time hourly rate shall be paid for all time worked over eight (8) hours worked in one day or shift and time worked on Saturdays. Double (2x) the regular straight time hourly rate shall be paid for all time worked on Sundays, holidays, and all time worked over twelve (12) hours in one day. Saturdays, Sundays, and Holidays from midnight to midnight.

WORKDAY & WORKWEEK: Single shift jobs are eight (8) consecutive hours with a starting time between 5:30 am and 8:00 am., Monday through Friday.

****Overtime and Double Time are calculated on the basic wage (base rate).**

SHIFT DIFFERENTIAL:

Two Shifts:

First shift	Start not earlier than 5am or later than 8am. Seven and one-half (7.5) consecutive hours, eight (8) hours pay
Second shift	Seven and one-half (7.5) consecutive hours, eight (8) hours pay

**Five consecutive days. Upon approval by Business Manager of the Union, may utilize two shifts for less than 5 consecutive days provided there is a legitimate business or bid specification requirement.*

Three Shifts:

First shift	Start at 8am unless modified by mutual agreement of union and the employer. 8 hours worked for 8 hours pay.
Second shift	Seven and one-half (7.5) hours worked for 8 hours pay
Third shift	Seven (7) hours worked for 8 hours pay

**Shifts shall run consecutively for five (5) days or more and with not more than one hour break between shifts. Upon approval by Business Manager of the Union, may utilize two shifts for less than 5 consecutive days provided there is a legitimate business or bid specification requirement. Must be a minimum of eight (8) hour rest period between shifts, otherwise employee will be paid at applicable overtime rate until a minimum of eight (8) consecutive hours of off duty time is allowed before the employees are required to report for work or begin work on a new shift.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Nevada Day	Thanksgiving Day	Family Day	Christmas Day

**If any of these holidays fall on Sunday, the Monday following shall be considered a holiday. If holiday falls on Saturday, the Friday before said holiday or the day observed by Nevada will be considered to be the holiday.*

.**JOB DESCRIPTION:**

Excerpt from Agreement between No. NV Masonry Contractors and LiUNA Local 169.

Conveying of all materials used by the Brick and Stone Masons from the first point of delivery to the Mechanic whether done manually or by a piece of machinery or equipment devised to replace the wheelbarrow or buggy, including but not limited to the forklift. The handling of Bricks, Blocks, mortar, or any other material to serve the bricklayer in any capacity building and dismantling scaffolds of any kind or type used by Bricklayers for masonry work including but not limited to tower scaffolds, access scaffolds, or other specialty scaffolds, mixing and tempering mortar by hand and/or machine, mixing grout and cleaning up after the bricklayer, the repairing and maintenance of all equipment, either on the job or in the yard.

Craft: HOD CARRIER-PLASTERER TENDER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Hod Carrier-Plasterer Tender-Journeyman	$57.12
Hod Carrier-Plasterer Tender- Gun Tender	$58.12
Hod Carrier-Plasterer Tender-Foreman	$58.48

ADD ZONE RATE:

In addition to HOD CARRIER-PLASTERER TENDER rates, add the applicable amounts per hour, calculated based on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone Rate	75 miles and over	Employee shall be paid the currently published IRS standard mileage rate per mile traveled to the jobsite and back to Reno, once up and once back on a continuous job, plus $8.00 per hour for hours worked or room and board at the choice of the Employer

ADD PREMIUM PAY:

One and one-half (1.5) the regular straight time hourly rate shall be paid for all time worked over eight (8) hours worked in one day or shift and time worked on Saturdays. Double (2x) the regular straight time hourly rate shall be paid for all time worked on Sundays, holidays, and all time worked over twelve (12) hours in one day. Saturdays, Sundays, and Holidays from midnight to midnight.

WORKDAY & WORKWEEK: Single shift jobs are eight (8) consecutive hours with a starting time between 5:30 am and 8:00 am., Monday through Friday.

****Overtime and Double Time are calculated on the basic wage (base rate).**

SHIFT DIFFERENTIAL:

Two Shifts:

First shift	Start not earlier than 5am or later than 8am. Seven and one-half (7.5) consecutive hours, eight (8) hours pay
Second shift	Seven and one-half (7.5) consecutive hours, eight (8) hours pay

**Five consecutive days. Upon approval by Business Manager of the Union, may utilize two shifts for less than 5 consecutive days provided there is a legitimate business or bid specification requirement.*

Three Shifts:

First shift	Start at 8am unless modified by mutual agreement of union and the employer. 8 hours worked for 8 hours pay.
Second shift	Seven and one-half (7.5) hours worked for 8 hours pay
Third shift	Seven (7) hours worked for 8 hours pay

**Shifts shall run consecutively for five (5) days or more and with not more than one hour break between shifts. Upon approval by Business Manager of the Union, may utilize two shifts for less than 5 consecutive days provided there is a legitimate business or bid specification requirement. Must be a minimum of eight (8) hour rest period between shifts, otherwise employee will be paid at applicable overtime rate until a minimum of eight (8) consecutive hours of off duty time is allowed before the employees are required to report for work or begin work on a new shift.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Nevada Day	Thanksgiving Day	Family Day	Christmas Day

**If any of these holidays fall on Sunday, the Monday following shall be considered a holiday. If holiday falls on Saturday, the Friday before said holiday or the day observed by Nevada will be considered to be the holiday.*

JOB DESCRIPTION:

Excerpt from Agreement between Plasterers Contractors and LIUNA Local Union 169.

Any Employee within the scope of this division tending or serving any other worker performing plasterers work, any plasterer, plasterers, or apprentices in any capacity performing plasterers work including but not limited to, handling and conveying of all materials after delivery used by plasters, including but not limited to, inside finish coat, outside finish coat, brown coat, scratch coat, sprayed or trawled on fireproofing, EIFS systems, and other materials or systems for the same or similar purpose whether done manually or by a piece of machinery or equipment devised to replace the wheelbarrow or buggy, including but not limited to the forklift, tusky hoist, and rigging and signaling for cranes to the point or points of application or installation, making mixing and preparing after delivery all materials used by plasters, whether by hand or machine including but not limited to mixers, pumps for plaster or fire proofing, plaster, finish coats, fireproofing, including Monocoat, Cafco or other materials for the same or similar use, moving any rolling scaffolding,

building and handling all necessary trestle, scaffolding and planking of scaffolding for plasterers and lathers, building mortar boxes, mortar boards and stands, and the repairing and maintenance of all equipment either on the job or in the yard, the spreading of all temporary protective drop cloths, building paper or plastic covers and taping of same (in a composite crew with the plasterers when necessary), the cleaning of all floors, and debris, behind the plasterers or any other worker performing plasterers work in connection with the work performed all work necessary for cold weather protection and cure including but not limited to handling installing or tending to blankets, visqueen, and space heaters, and running putty. Tending to plasterers or any other worker performing plasterers work on EFIS system work shall include all work after the wallboard is installed including but not limited to any preparatory sealing or leveling, placing foam, mesh, and plaster including any rough, finish, and color coats.

Craft: IRONWORKER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Ironworker - Journeyman	$90.97
Ironworker - Foreman	$96.16

**Foreman-not less than 10% more than the regular hourly rate of highest paid Journeyman*

ADD ZONE RATE:

In addition to IRONWORKER rates, add the applicable amounts per day, calculated based on a road mile from Reno City Hall.

Zone 1	60 – 75 miles	$20.00 per day
Zone 2	75 – 100 miles	$25.00 per day
Zone 3	100 miles and over	$75.00 per day

ADD TRAVEL REIMBURSEMENT:

In addition to IRONWORKER rates and Zone Pay, the workmen shall be paid a travel reimbursement at the beginning and completion of the job, based on a road mile from Reno City Hall, Nevada:

60 – 75 miles	$25.00 per day
75 – 100 miles	$50.00 per day
100 miles and over	$60.00 per day
Each additional 50 miles	$25.00 per day

ADD PREMIUM PAY:

Time and one-half (1.5) shall be paid for the first two (2) hours worked in excess of eight (8) hours on any regular workday and for the first eight (8) hours worked on Saturday. Double time (2x) to be paid for hours worked over eight (8) on Saturday; all hours over ten (10) in one day; all hours worked on Sunday and holidays.

WORKDAY & WORKWEEK: Eight (8) hours from 5:00 a.m. to 5:00 p.m., Monday through Friday. Day shift may start earlier than 5:00 am if the Union is notified before making the change in start time.

****Overtime and Double Time are calculated on the base rate of pay.**

SHIFT DIFFERENTIAL:

First shift (Day)	Start between 5:00 am and 9:00 am	Standard hourly wage
Second shift (Swing)	Start not later than 5:30 pm	Add 6% of hourly wage
Third shift (Graveyard)	Start not later than 2:30 am	Add 13% of hourly wage
Dedicated shift	Shift outside of regular workday of not less than three (3) days at eight (8) hours worked per day	Add 6% of hourly wage

RECOGNIZED HOLIDAYS:

New Year's Day	Martin Luther King Jr. Day	Presidents' Day	Memorial Day
Independence Day	Labor Day	Admission Day	Veterans Day
Thanksgiving Day	Day after Thanksgiving Day	Christmas Day	

**All holidays falling on Sunday will be observed on the following Monday, all holidays falling on Friday will be observed the preceding Friday*

JOB CLASSIFICATION:

Excerpt from Agreement between NV AGC and DC of Ironworkers, Local 118.

All work in connection with energy producing windmill type towers, wind turbine erection, wind turbine to include but not limited to prep work, bolt up, tensioning or torquing of bolts on base, and all tower section turbine and blade assemblies, turbine towers and cylinders, turbine jackets, turbine blades and rotors, all work in conjunction with assembly and erection of nacelle housings, assembly of interior and exterior platforms for wind turbine towers. All work in connection with Offshore Wind installation, maintenance, manufacturing, rigging and erection including anchorage systems, pylon and steel bases on and offshore locations. All work in connection with multilayered beams, columns, floor panels, including rigging, connecting, bolting up and welding regardless of composition, including plumbing, unloading, and field modification of structural members. All associated waterproofing and integrated flashing systems. All work associated with the installation, modification and welding of stainless steel, including but not limited to reinforcing members, columns, girders, beams, grating, architectural panels and sheeting, handrail, including caps, shoes, and other metallic components. All

work associated with autonomous and semi-autonomous robotic rebar machines and rebar carrying and placing robots. All work associated with autonomous and semi-autonomous robotic welding machines and equipment.

Field fabrication and/or erection or deconstruction of structural, ornamental and reinforcing steel, including but not limited to the fabrication, rigging and signaling, erection and construction of all iron and steel, ornamental lead, bronze, brass, copper and aluminum, plastics and all other substitute materials, including, but not limited to, composites, carbon fiber and fiberglass, all barrier railings, handrail, aluminum, steel, glass and plastic, reinforced concrete structures or parts thereof; bridges, viaducts, inclines, dams, docks, dredges, vessels, locks, gates, guides, aqueducts, reservoirs, spillways, flumes, caissons, cofferdams, subways, tunnels, cableways, tramways, monorails, blast furnaces, stoves, kilns, coolers, crushers, agitators, pulverizers, mixers, concentrators, ovens, cupolas, roof decking such as but not limited to "Cofar", "Trusdeck", Mahon "M"; smoke conveyors, penstocks, flag poles, drums, shafting, shoring, fur and storage rooms, fans and hot rooms, stacks, bunkers, conveyors, dumpers, elevators, vats, tanks, enamel tanks, enamel vats, towers, pans, hoppers, plates, anchors, caps, corbels, lintels, Howe and combination trusses, grillage and foundation work, grating, bucks, partitions, hanging ceilings, hangers, clips, brackets, flooring, floor construction and domes, rolling shutters, curtains, frames; aluminum, rolling fire, won and iron doors, including supports; cast tiling, air ducts, duct and trench frames and plates; wire work, railings, wire cable including pipe, guards, fencing, grill work, sidewalk and vault lights, skylights, roofs, canopies, light steel framing, marquees, awnings and other related equipment elevator and dumb waiter enclosures, elevator cars, tracks, fascias, aprons, operating devices, steel and aluminum sash, hardware and screens, frames, fronts, lockers, racks, book stacks, tables, shelving, metal furniture, seats, chutes, escalators, stairways including pre-engineered stairs, ventilators, boxes, fire escapes, signs, jail and cell work, safes, vaults, vault doors, safe deposit boxes, corrugated sheets when attached to steel frames, including insulation; frames in support of boilers; materials altered in field such as framing, cutting, bending, drilling, burning and welding including by acetylene gas and electric machines; metal forms and false work pertaining to concrete construction; seismic isolation systems and dampening systems including base isolators, sectional water tube and tubular boilers and stokers; traveling sheaves, vertical hydraulic elevators, bulkheads, skip hoists, making and installation of articles made of wire and fibrous rope, rigging in connection with pumps, compressors, forced and induced draft fans, air meters, Bailey meters, agitators, oxygen converters, cindering machines, pelletizing machines, reactor vessels, reactor spheres, completed tanks and assembled sections of completed tanks, scroll cases, refineries, hydroelectric power houses and steam plants, cogeneration plants, vessels and government departments; false work, travelers, scaffolding, pile drivers, sheet piling, derricks and powered derrick swinger including the erection, installation, handling and operating. Cranes erection, installation, handling and operating of same on all forms and types of construction work. The operation of Valla and Spider type battery and/or propane powered portable floor cranes having no operator seat utilized to install ironworker scope of work and the same on all forms and types of construction work. Crane work at the ports, including hammer-head cranes, container cranes and rubber tire cranes. Offloading, relocations, and commissioning of all burning and removal of sea bracing track layout; erection of apex boom extensions, back reach extensions, and rail replacement. Includes all welding, containment and structural modifications of the aforementioned items; railroad bridge work including maintenance thereof; moving, hoisting and lowering of machinery, modules, skid modules and placing of same on foundation, including bridges, cranes, intermittent use forklifts, derricks, buildings, piers and vessels; loading, unloading, necessary maintenance, erection, installation, removal, wrecking and dismantling of all of the above and all reinforcing work and submarine diving in connection with or about same; erection of steel towers, chutes and spouts for concrete where attached to towers and handling and fastening of cables and guys for same; unloading, racking, sorting, cutting, bending, hoisting, placing and tying including the use of any and all mechanical tying devices, burning and welding including stud welding of all iron, steel and metal in reinforced concrete construction including mesh for floor arches and the making of hoops and stirrups, metal forms and metal supports thereof; jacking of slip forms, installation of all wire, cable, parabolic cans, steel and all other materials, including, but not limited to, composites, carbon fiber and fiberglass, used for the purposes of prestressing including grouting of ducts, post stressing concrete girders, beams, columns, etc.; loading, unloading, hoisting, handling, signaling, placing and erection of all prestressed, post stressed, precast materials, G.F.R.C., Dryvit System, including the securing by bolting and/or welding and the installation of steeltex and wire mesh of any type when used for reinforced concrete construction; erection of all curtain wall; glass handrail; stay in place deck; automated and/or mechanical parking structures; offloading, staging, hoisting and setting of modular structures and micro-units; curtain wall systems and associated sealants. Window wall and entrances, panels, insulated and non-insulated, factory and field assembled, porcelain enameled panels, ceramic, laminated spandrelite, louvers and sunscreens; application of thiokol, neoprene and other sealants used to seal materials installed by Iron Workers; installation and handling of phenolic panels, including but not limited to, Trespa products and all similarly related materials and/or systems; installation of metal window stools and sills; installation of aluminum, bronze and steel thresholds; erection and dismantling of all types of cranes and changing of booms; erection of rock, sand and gravel plants, dismantling and loading out conveyors, aggregate plants, batch plants, ableways, refrigeration plants, etc.; erection and dismantling of Monigan walking dragline, launchhammer bucket wheel excavator and other trenching equipment; signaling on highlines, whirley cranes and derricks, buck hoists, man hoists, fork lifts, material towers and scanning antennae; metal and steel supports of all types; fabrication, assembling and erection of offshore drilling platforms or similar installations; dust collectors, precipitators, multi-plate, specialty welding processes, unloading, loading, hoisting, handling and rigging of all building materials delivered to the job site; hanging ceilings, tees, channels, beams, acoustical elements, sound barriers, computer floors, etc.; installation of stage rigging (including counterweights), curtains, draperies, traverse rods, tracks, cables, window cleaning equipment, powered work platforms, including and loading and unloading, erection installation and removal of powered chassis mounted elevating mast climbing work platforms, rigging in connection with display shows; ski lifts, etc.; wrecking of bridges, viaducts, elevated roads and structural steel and iron in buildings; all steel frames for openings, all porches, verandas, canopies and balconies; all overhead travelers, duo rails, tram rails; erection, setting, repairing of guard or collision rails on bridges and approaches, road ways or any other structures; handling and setting of all types of steel and metal joists, including metal box joists for truss lab and preformed keystone shaped metal joists; erection of steel and metal houses and packaged buildings; all translucent and plastic material on steel frame construction; the erection of solar energy systems, including but not limited to, photo voltaic, heliostat and parabolic systems, energy producing windmill type towers, wind turbine erection to included, but not limited to, prep work, boltup, tensioning or torque of bolts on base and all tower section turbine and blade assemblies; nuclear reactors, electromagnetic shielding plates and atomic vessels including all component parts; the plumbing, aligning and leveling of all materials and equipment through the use of optical

instruments, LASER beams, etc., and the use of instruments to establish layout, installation and disposition of ironworker installed scope of work; the unloading, distributing, stockpiling and handling of all materials coming under the jurisdictional claims of the UNION such as to rail heads, storage yards, loading and unloading, hoisting, handling, signaling of all fabricated material and equipment at the jobsite (except FOB deliveries) related to the Iron Workers jurisdiction that is within the individual employers' contractual scope of work including from and to barge and ships to a lay down yard or construction project, etc., shall be done by the Iron Workers.

All reinforcing work in connection with field fabrication, including but not limited to the pre-assembly of reinforcing cages, loading and unloading, handling, racking, sorting, cutting, bending, hoisting, intermittent use of forklifts, placing, burning, welding and tying of all material including the use of any and all mechanical tying devices, or substitute materials, including but not limited to, composites, carbon fiber and fiberglass, stainless steel, used to reinforce concrete construction shall be done by Iron Workers within the individual employers' scope of work at the jobsite, excluding FOB deliveries. A working Iron Worker shall be employed for maintenance on jobs of substantial size while concrete is being poured on reinforcing steel, wire mesh and paper back steeltex but will not be required as a stand-by man. All work in connection with the installation, alignment, repair & modification of panelized roofing systems, pre-engineered fabric structures, aluminum clarifier coverings, carports, ministorages, and dock planks. All work in connection with the installation, alignment, repair and modification of bleachers, planking and stadium seating. All work in connection of installation of amusement rides including, but not limited to, the erection and alignment of all track, machinery and related components.

Craft: LABORER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Landscaper	$51.12
Furniture Mover	$52.62
Group 1	$56.28
Group 1A	$55.41
Group 2	$56.38
Group 3	$56.53
Group 3A	$59.96
Group 4	$56.78
Group 5	$57.08
Group 5A	$59.03
Group 6 Nozzlemen, Rodmen	$56.08
Gunmen, Materialmen	$56.08
Reboundmen	$56.08
Laborer Foreman	$62.03

ADD ZONE RATE:

In addition to LABORER, add the applicable amounts per hour, calculated based on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$6.00
Zone 3	150 to 300 miles	$7.00
Zone 4	300 miles or over	$8.00

**No remote area pay shall be paid within ten (10) miles of employee's permanent place of residence in the State of Nevada.*

ADD PREMIUM PAY:

One and one-half (1.5) the regular straight time hourly rate shall be paid for all time worked over eight (8) or ten (10) (if on 4/10 schedule) in one day and on Saturdays. Sundays, Holidays, and all hours worked over twelve (12) in one day are to be paid at double (2x) the regular straight time hourly rate.

WORKDAY & WORKWEEK: Single shift jobs are eight (8) consecutive hours with a starting time between 5:30 am and 8:00 am., Monday through Friday.

****Overtime and Double Time shall be calculated on the Taxable Wage (base rate).**

SHIFT DIFFERENTIAL:

Second (swing) and Third (graveyard) shifts	Shall be paid a 12.5% differential

**Upon approval the Employer may utilize multiple shifts for less than five (5) consecutive days provided there is a legitimate business or bid specification requirement and the shift differential is paid.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Admission (Nevada) Day	Thanksgiving Day	Family Day	Christmas Day

**If any of these holidays fall on Sunday, the Monday following shall be considered a holiday.*

JOB DESCRIPTION:

Excerpt from Agreement between AGC and LiUNA Local 169

The construction, erection, alteration, repair, modification, demolition, addition, improvement of all building, heavy and highway, utility, industrial and all other type(s) of construction.

(SEE LABORER GROUP CLASSIFICATIONS)

Craft: LUBRICATION AND SERVICE ENGINEER (EQUIPMENT GREASER MOBILE AND GREASE RACK) (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Lubrication and Service Engineer (Mobile and Grease Rack) (OE Group 7)	$82.18

ADD ZONE RATE:

In addition to LUBRICATION AND SERVICE ENGINEER (MOBILE AND GREASE RACK) rates, add the applicable amounts per hour calculated based on road miles from the Carson City Courthouse or Washoe County Courthouse.

Zone 1 – (Carson City or Washoe County Courthouse)	0 to 75 miles	$0.00
Zone 2 – (Washoe County Courthouse)	75 to 150 miles	$5.00
Zone 3 – (Washoe County Courthouse)	150 to 300 miles	$6.00
Zone 4 (Washoe County Courthouse)	300 miles and over	$7.00

ADD PREMIUM PAY:

One and one-half (1.5) times the applicable straight-time rate for the day, shift, work, equipment, and classification shall be paid for all work performed on Saturday and before a shift begins and after it ends, except when operating equipment servicing a craft that is receiving double time on commercial building construction, in which case double (2x) time shall be paid. All work performed on Sundays, holidays, and over twelve (12) hours in one (1) day shall be paid at two (2) times the appropriate hourly rate.

WORKDAY & WORKWEEK: Regular shift is eight (8) consecutive hours starting between 5:00 am and 10:00 am.

SATURDAY: On any shift, Saturday shall be the twenty-four-hour period commencing at 12:00 midnight Friday.
SUNDAY: On any shift, Sunday shall be the twenty-four-hour period commencing at 12:00 midnight Saturday.

****Overtime and Double Time are calculated on the base rate/Taxable Income.**

SHIFT DIFFERENTIAL:

Special/Night Shift	Work done outside the regular shift hours	Add 12.5% to base rate

RECOGNIZED HOLIDAYS

New Year's Day	Memorial Day	Independence Day	Labor Day
Nevada Day	Thanksgiving Day	Family Day	Christmas Day

**Holidays falling on Sunday shall be observed the following Monday*

(SEE OPERATING ENGINEERS LOCAL 3 GROUP 7)

Craft: MECHANICAL INSULATOR (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Mechanical Insulator-Mechanic	$87.87
Mechanical Insulator-Foreman	$93.87
Mechanical Insulator-General Foreman	$95.87

ADD ZONE RATE:

In addition to MECHANICAL INSULATOR rates, add the applicable amounts per day, calculated based on a radius figured from Reno City Hall:

Zone 1	0 to 20 miles	$18.00
Zone 2	21 to 40 miles	$28.00
Zone 3	41 to 60 miles	$38.00
Zone 4	Over 60 miles	$140.00

ADD PREMIUM PAY:

One and one-half (1.5) times the minimum hourly wage rate shall be paid for the first two (2) hours of overtime work, directly following eight (8) hours Monday through Friday, and for the first ten (10) hours worked on Saturdays. Double (2x) the minimum hourly wage rate shall be paid for all other overtime worked Monday through Friday; in excess of ten (10) hours on Saturdays, Sundays, and holidays.

WORKDAY: Workday commences at 8:00 am, Monday through Friday. May be changed to between 5 am and 8 am if particular job conditions permit.

***Overtime and Double Time are calculated on the straight time hourly rate, base rate.**

SHIFT DIFFERENTIAL:

First Shift (Day)	Starts at 8:00 am and ends at 4:30 pm	Regular straight wage rate
Second Shift (Day)	Starts at 4:30 pm and ends at 12:30 am	Paid at 110% of the regular wage rate for the hours worked, plus one-half hour (0.5)
Third Shift (Graveyard)	Starts at 12:30 am and ends at 8:00 am	Paid at 115% of the regular wage rate for the hours worked, plus one (1) hour

** If only one shift is worked, the pay rate shall be 110% other than the regular shift. Shift work must remain in effect for no less than five (5) consecutive working days. Must start on the 1st regular workday of the week. Should the shift be less than five (5) working days, the first eight (8) hours of each day shall be paid at the rate of one and one-half (1.5) times the applicable rate.*

RECOGNIZED HOLIDAYS:

New Year's Day	Martin Luther King Jr.'s Birthday	Memorial Day	Independence Day
Labor Day	Veteran's Day	Thanksgiving Day	Day after Thanksgiving Day
Christmas Day			

**If a holiday falls on a Saturday the preceding Friday will be considered the holiday, if a holiday falls on Sunday the following Monday will be considered the holiday. Triple (3) the regular straight time should be paid for all time worked on Labor Day.*

JOB DESCRIPTION:

Excerpt from the Int'l Assoc. of Heat and Frost Insulators and Allied Workers Local 16 and the No. CA Chapter. Western Insulation Contractors Assoc.

Lining of all mechanical room surfaces and air handling shafts. The filling and damming of fire stops and penetrations including, but not limited to, electrical and mechanical systems. All foam applications for the purpose of thermal, acoustical, or fire protective purposes, including RTV foams or equivalents, applied to mechanical or electrical systems. All duct lining, and duct wrapping, done on the job site, direct application and installation of fire protection of grease ducts, exhaust systems, or any other ductwork for acoustical or thermal purposes. The insulation of all field joints on pre-insulated underground piping, and the pouring of Gilsilite or its equivalent. Any finish material which is contiguous to the thermal or acoustical application. The preparation, distribution of materials on job sites, assembling, molding, spraying, pouring, mixing, hanging, adjusting, repairing, dismantling, reconditioning, maintaining, finishing, and weather proofing of hot or cold thermal or acoustical insulation with such materials as may be specified. The application of any material, including metal and PVC jacketing, Alumaguard or equivalent**,** on piping, fittings, valves, flanges, boilers, ducts, plenums, flues, tanks, vats, equipment and any other hot or cold surface for the purpose of thermal control.

Craft: MILLWRIGHT (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Millwright Journeyman	$83.97
Millwright Welder	$86.97
Millwright Foreman	$89.05
Millwright General Foreman	$94.64

ADD ZONE RATE:

In addition to MILLWRIGHT rates, add the applicable amounts per hour, calculated via the "shortest route" filter using Google Maps from City Hall in Reno, Nevada.

Zone 1	Up to 45 Miles	$0.00
Zone 2	More than 45 miles but less than 101 Miles	$4.00
Zone 3	101 or more Miles	$6.00

ADD PREMIUM PAY

Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight-time work shall be paid at one and one-half (1.5) times the straight-time rate of pay. All additional overtime will be paid at two (2) times the straight-time rate of pay.

On a four (4) day-ten (10) hour shift, Monday through Thursday or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight-time work shall be paid at one and one-half (1.5) times the straight-time rate of pay. All additional overtime will be paid at two (2) times the straight-time rate of pay. On a four (4) day-ten (10) hour shift, the first twelve (12) hours of work on the fifth day (Friday or Saturday, as applicable) will be paid at one and one-half (1.5) times the straight-time rate of pay; provided the fifth day is not a voluntary make-up day. All additional overtime shall be paid at two (2) times the straight-time rate of pay.

All work performed on Sunday and Holidays shall be paid at two (2) times the straight-time rate of pay. Any work performed on Labor Day shall be paid at triple (3x) the regular straight-time hourly wage rate.

WORKDAY: Eight (8) hours of continuous work between 5:00 a.m. and 6:00 p.m.

****Overtime and Double Time are calculated on the Taxable Wage (base rate):**

SHIFT DIFFERENTIAL:

Two-Shift Operation: (1st shift)	Eight (8) or ten (10) hours of continuous employment between the hours of 6:00 a.m. and 6:00 p.m., except for lunch period at mid-shift	Straight time hourly wage rate
Two-Shift Operation (2nd shift):	Eight (8) or ten (10) hours of continuous employment between the hours of 6:00 p.m. and 6:00 a.m., except for lunch period at mid-shift	Additional $2.00 per hour

Three-Shift Operation (1st shift):	Eight (8) hours of continuous employment, except for an unpaid meal period at mid-shift, between the hours of 5:00 a.m. and 6:00 p.m.	Straight time rate of pay
Three-Shift Operation (2nd shift):	Shall be eight (8) hours of continuous employment, except for an unpaid meal period at mid-shift	Additional $2.00 per hour
Three-Shift Operation (3rd shift):	Eight (8) consecutive hours of employment, except for an unpaid meal period at mid-shift.	Additional $3.25 per hour

RECOGNIZED HOLIDAYS:

New Year's Day	Presidents' Day	Memorial Day	Independence Day
Labor Day	Veterans Day	Thanksgiving Day	Day after Thanksgiving Day
Christmas Day			

**When any of these holidays falls on Sunday, then the following Monday shall be considered a legal holiday. If the Holiday falls on a Saturday, the preceding Friday shall be considered a holiday.*

JOB DESCRIPTION:

Excerpt from Southwest Regional Council of Carpenters' Millwright Regional Master Construction Agreement, Local 1607

The machinery, equipment, processes and associated components listed below which are identified for the purpose of description only, falls within the jurisdiction of the United Brotherhood of Carpenters and Joiners of America (Millwrights). Although some components of machinery and/or equipment may be described in one application or location and not in another, it shall not be excluded from our craft jurisdiction when, to avoid repetition, it is not described in other applications, and such jurisdiction shall be applied to the initial commissioning, maintenance, decommissioning, and recommissioning of all associated machinery and/or equipment.

Loading, unloading, hoisting, rigging by any means, transferring, moving, cleaning, disassembling, assembling, moving and setting and removal of skids, welding, burning, erecting, calibrating, precision grouting, supporting, aligning, starting-up and testing, adjusting, repairing, and the maintaining of all machinery and equipment, be it powered by, or receiving power from, steam, gas, gasoline, diesel, biodiesel, hydrogen, jet, electric, pneumatic, magnetism, adiabatics, diabatics, isothermics, water, hydropnuematics, solar, thermal, mineral, atomic, rocket, nuclear, chemical, wind, waste product of any kind or any other source, regardless of whether or not such machinery or equipment is temporarily or permanently installed or located.

All activities necessary to: set all engines, motors, dynamos, generators, diesel generators, motor restraints and supports; install, measure and align with optical and/or electronic instruments when necessary the reactors, control, push and shut-down rods, rod pressure housing, drives, guide sleeves and other related equipment in reactors, turbines, castings, combustion chambers and all its related components; the attachment and final connection of the inlet manifolds and exhaust ducts, cylinders, diaphragms, gaskets, containment barriers, rotors, blade rings, blade or bucket assemblies, hydrogen coolers, blower assembles, packing joints on hydrogen coolers, exciter or Alterex and all others, turning gear, extension box, welding of extension box, lagging, stretching of coupling bolts or others; perform oil flush; install turbine lube oil tank, pumps and related component skids, filters, thrust bearings, magnetic bearings, the sweating on and shrinking of bearings, couplings, shafts and others, sole plates and machine bases; perform all precision grouting using the following materials: epoxy, wet, non-shrink, dripacking or other types; perform demineralizing and hydromation; install mechanical dust systems, sensors, air compressors, super charges, coolers, boiler controls and linkage, thermal management systems, Bailey Meters or similar devices and their linkages; installation, maintenance and removal of all instrumentation, gauges, antennae and other communication devices, fluid drives, power drive trains, embedded guides for traveling screens, traveling screens, roller, slide, knife, lock and sluice gates, limit torques on mechanical valves, gates and others, tainter valves, limit switches, trips, triggers or switches, including the brackets that are attached to, stop logs, dam rollers, transfer cars and gear head motors.

The setting of variable drives, fans, coal cranes, truck cranes or other types, including servicing and the adjusting and aligning of mechanical equipment within the cranes, crane rails and all other types of rails which would carry mechanically activated equipment, including their alignment, installation, removal, servicing, and alignment of hydraulic and pneumatic lifts and passenger boarding bridges, monorail (all sizes), magnetic propulsion systems, trolleys, pumps and their associated components, packaging equipment, refrigerating equipment, chillers, and related equipment, lantern rings, packing glands, packing for pumps, pollution equipment, carbon absorbers and filtration, heat exchanges, grain, ball, hammer, roller mills, pulverizers and others, crushers and beaters, hoppers, bins, chutes and spouts, turn tables, shears, casing machines, robots, air-veyors, conveyors of all sizes, types, and styles regardless of the materials they are constructed with, or mechanically powered conveyances of any type, including their supports, people movers, x-ray and imaging & scanning machines, elevator and platform lifts, dock levelers and locks, roll-up and sectional doors, operable partitions, retractable roofs, magnetic separators, hoists, feeding machinery, Z-loaders, S-loaders, palletizers, Triax equipment, mechanical equipment in scrubbers, pack towers, precipitators, cooling towers and air cooled condensers.

Sewage, Brackish, Desalination, Water Treatment and Mineral Extraction Plants — the disassembly, fabricating, rigging, erecting and aligning of skimmers, rake mechanisms, feed wells, baffles, scum troughs, de-gritting equipment, bar screens, communitors, mixers, pumps, aeration systems, blowers, membrane filtration systems, sequencing batch reaction systems, including related, filter presses, sand filtration systems, ultra violet rack systems, mechanical drive assemblies, conveyors, lines, piping, flanges, brackets, supports, mono rails, gates and setting odor control and detection equipment, (excluding heating, ventilating and air conditioning work). The setting of thru-clean bar, straight line bar, trash, tritor drum, and disc screens, straight line grit, circuline grit, circuline sludge, and circuline mixer collectors, straight line, flash, horizontal slow, vertical slow, and vibra flow feeder machines, pre-aeration and settling tanks, covers for tanks, bowls and basins including stationary or mechanical covers regardless of materials, thickeners, rotoline distributors, sludge bed and settling pond cleaners, digestion systems, heaters, dyna-grind sewage screening grinders, screw pumps, spiral classifer, agitators, junk remover, hydro pulper, cooling fans, lube systems, selectifier screens, hydrosensors, fuel blowers, grizzly screens, trommels, table feeders, dryers, optical sorters, high tension separators, grip dewatering screens, flash mixer, horizontal slow mixer, vertical slow mixer, filter, cone and rotary presses, comminutors, barminutors, degreasers, rotometers, dehumidifiers, benches, pressure cleaning systems & devices, washers for cars, trucks, buses, trains, planes unmanned and autonomous vehicles and other types, hydraulic, servo and pneumatic units, shroud boxes, silencers, scales, load cells, eddy current clutches, disintegrators, dehairing machines, grain handling devices, laboratory equipment, machine shop equipment, ladle cars, stunning pens and doors and gates, activation equipment, racks, material handling platforms, access & egress platforms, catwalks, transition pieces, the handling and installation, of pulleys, gears, fluid couplings, sheaves and fly wheels, air vacuum, worm, belt, friction, rope, magnetic, chain and gear drives that are directly or indirectly coupled to motors, belts, chains, shafts, or screws, installation of legs, boots, guards and boot tanks, all bin and diverter valves, turn hands and indicators, shafting, bearing cable sprockets, cutting of all key seats in old and new work, troughs, chippers, calenders, rolls, winders, rewinders, slitters, cutters, wrapping machines, blowers, forging machines, pneumatic, electric and hydraulic rams, servo actuators, extractors, expellers and extruders, ball and dust collectors, splicing of ropes and cables.

Millwright craft jurisdiction on energy generation facilities shall include all loading, unloading, movement, hoisting, preparation, uncrating, preparation of nacelle units prior to installation or removal, installation, setting, removal, alignment, and final torquing and tensioning of any mechanical component used in the generation of power, including any incidental wiring or piping. This shall include all aspects of power trains, drive and tracking systems,

elevation and azimuth drives, energy collection optimization systems, all rams, dampers and other stabilization devices, antennae, bearing housing assemblies and units, actuators, pulleys, gears, access points, rotational connections, mounting and alignment of tracks, axles, bearings, rotational joints, or any other device which allows for the automated or manual movement of equipment post-installation, all turbines, and wind, wave and tidal analysis equipment. It shall also include all work associated with energy collection and storage facilities, including the loading, unloading, movement, hoisting, preparation, installation, setting, and alignment of racking systems, torque tubes, modules, batteries, energy storage systems, cooling or control systems, inertia systems or other equipment or machinery, and all incidental wiring or piping thereof.

The laying out, fabrication and installation of protecting equipment including: machinery guards; the making and setting of templates for machinery; the fabrication of bolts, nuts, pans; the drilling or creating of holes in machinery for any equipment which the Millwrights install, remove, service or inspect, regardless of material; installation of all methods of access and egress and safety devices whether temporary or permanent; all welding and burning regardless of type; the fabrication of all lines, hose or tubing used in the lubrication, operation, cooling or heating of machinery, including the installation of all fluids used to operate, lubricate, cool or heat equipment installed by Millwrights; the cleaning or pressure cleaning of machinery; the machining, grinding, milling, broaching, boring, threading, lapping, field machining, technical bolting and keying that may be necessary for any part of equipment, including the starting up, breaking in, trial running and operational or functional testing of any equipment or machinery installed or handled by the Millwrights, the initial programing of robotics for startup, and the incidental connection and disconnection of machinery and equipment from piping and electrical systems.

Rock, sand and gravel plants, mineral processing plants and batch or aggregate plants: Installation, removal and maintenance of all recycling equipment, separators, centrifuges, classifiers, grates, crushers, conveyors, chutes or piping from one piece of mechanical equipment into another piece of mechanical equipment, or from a vessel into a conveyor, or into other places or mechanical equipment or other mechanical equipment used (for the purpose of description only) to excavate material from one area to another from highways, roadways, waterways or elsewhere.

When optical instruments such as total stations or similar devices, automatic levels, builder’s transits, precision jig transits, tilting levels, theodolites or other precision tools and instruments are used to locate, set, scan-to-BIM or as-Built measure and verify machines, these tools are considered a tool of the Millwright trade and are to be used by Millwrights to set the equipment or machinery.

Incidental asbestos removal on equipment in which Millwrights normally remove during maintenance and repair work. Any new equipment or technology designed to replace any of the equipment described above shall remain in the craft jurisdiction of the Millwrights.

Craft: OPERATING ENGINEER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Group 1	$77.16
Group 1A	$79.92
Group 2	$80.45
Group 3	$80.72
Group 4	$81.46
Group 5	$81.76
Group 6	$81.93
Group 7	$82.18
Group 8	$82.77
Group 9	$83.09
Group 10	$83.44
Group 10A	$83.63
Group 11	$83.87
Group 11A	$85.51
Group 11B	$86.32
Foreman	$85.51

Add 12.5% to base rate for “Special/Night” Shift

Add Operating Engineers Zone Pay
Add Premium Pay

Craft: OPERATING ENGINEER (Union Rate)
STEEL FABRICATOR & ERECTOR

Prevailing wage rates include the base rate as well as all applicable fringes

Group 1	$92.46
Group 1 Truck Crane Oiler	$86.29
Group 1 Oiler	$84.33
Group 2	$90.95
Group 2 Truck Crane Oiler	$86.04
Group 2 Oiler	$84.12
Group 3	$89.71
Group 3 Truck Crane Oiler	$85.82
Group 3 Oiler	$83.90
Group 3 Hydraulic	$85.49
Group 4	$87.98
Group 5	$86.88

Add 12.5% to base rate for “Special/Night” Shift

Add Operating Engineers Zone Pay
Add Premium Pay

Craft: OPERATING ENGINEER (Union Rate)
PILE DRIVER
Prevailing wage rates include the base rate as well as all applicable fringes

Group 1	$91.83
Group 1 Truck Crane Oiler	$86.47
Group 1 Oiler	$84.55
Group 2	$90.39
Group 2 Truck Crane Oiler	$86.26
Group 2 Oiler	$84.35
Group 3	$88.94
Group 3 Truck Crane Oiler	$86.04
Group 3 Oiler	$84.12
Group 4	$87.43
Group 5	$86.32
Group 6	$83.04
Group 7	$84.25
Group 8	$83.29

Add Operating Engineers Zone Pay
Add Premium Pay

ZONE RATE & PREMIUM PAY LANGUAGE FOR ALL OPERATING ENGINEER CRAFTS
(OPERATING ENGINEER, OPERATING ENGINEER STEEL FABRICATOR & ERECTOR, OPERATING ENGINEER PILE DRIVER)

ADD ZONE RATE:
In addition to OPERATING ENGINEER, OPERATING ENGINEER STEEL FABRICATOR & ERECTOR, OPERATING ENGINEER PILE DRIVER rates, add the applicable amounts per hour calculated based on road miles from the Carson City Courthouse or Washoe County Courthouse

Zone 1 – (Carson City or Washoe County Courthouse)	0 to 75 miles	$0.00
Zone 2 – (Washoe County Courthouse)	75 to 150 miles	$5.00
Zone 3 – (Washoe County Courthouse)	150 to 300 miles	$6.00
Zone 4 (Washoe County Courthouse)	300 miles and over	$7.00

ADD PREMIUM PAY:
(OPERATING ENGINEER, OPERATING ENGINEER STEEL FABRICATOR & ERECTOR, OPERATING ENGINEER PILE DRIVER):
One and one-half (1.5) times the applicable straight-time rate for the day, shift, work, equipment, and classification shall be paid for all work performed on Saturday and before a shift begins and after it ends, except when operating equipment servicing a craft that is receiving double time on commercial building construction, in which case double (2x) time shall be paid. All work performed on Sundays, holidays, and over twelve (12) hours in one (1) day shall be paid at two (2) times the appropriate hourly rate.

WORKDAY & WORKWEEK: Regular shift is eight (8) consecutive hours starting between 5:00 am and 10:00 am.

SATURDAY: On any shift, Saturday shall be the twenty-four-hour period commencing at 12:00 midnight Friday.
SUNDAY: On any shift, Sunday shall be the twenty-four-hour period commencing at 12:00 midnight Saturday.

****Overtime and Double Time are calculated on the base rate/Taxable Income.**

SHIFT DIFFERENTIAL:

Special/Night Shift	Work done outside the regular shift hours	Add 12.5% to base rate

RECOGNIZED HOLIDAYS

New Year's Day	Memorial Day	Independence Day	Labor Day
Nevada Day	Thanksgiving Day	Family Day	Christmas Day

**Holidays falling on Sunday shall be observed the following Monday*

JOB DESCRIPTION:
Excerpt from the Master Agreement for Northern Nevada between Nevada Chapter AGC and Operating Engineers Local 3, includes but is not limited to:

Operate one or several types of power construction equipment, such as motor graders, bulldozers, scrapers, compressors, pumps, derricks, shovels, tractors, or front-end loaders to excavate, move, and grade earth, erect structures, or pour concrete or other hard surface pavement.

(SEE OPERATING ENGINEER GROUP CLASSIFICATIONS)

Craft: PAINTER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Brush/Roller Painter	$59.14
Spray Painter	$61.14
Paperhanger	$62.09
Specialty Pay (Faux Finish, Graining, Marbelizing)	$61.25
Swing Stage	$61.64
Protective Coating Application-Brush	$62.14
Protective Coating Application-Industrial Spray	$64.14
Foreman (3 or More) ($2.50 above highest paid journeyman being supervised)	$61.64
Foreman (6 or more) ($3.50 above highest paid journeyman being supervised)	$62.64

ADD ZONE RATE:

In addition to PAINTER rates, add the applicable amounts per day calculated based on road miles from the Washoe County Courthouse.

Zone 1	0 to 70 miles	$0.00
Zone 2	Over 70 miles	$75.00

**Excludes the City limits of Fallon and the Fallon NAS.*

ADD PREMIUM PAY:

The first four (4) hours worked outside a regular constituted shift and the first ten (10) hours worked on Saturday will be paid at one and one-half (1.5) the straight time rate. All hours worked beyond twelve (12) hours, hours worked beyond ten (10) on Saturday, and hours worked on Sundays and holidays are to be paid at two (2) times the straight time.

****Overtime and Double Time are to be calculated on the base rate of pay.**

WORKDAY & WORKWEEK: From 6:00 am to 6:00 pm, Monday through Friday. Regular constituted shift is a 5/8 or 4/10 schedule.

SHIFT DIFFERENTIAL:

Shift work is work performed outside the regular workday	Paid ten percent (10%) above the employee's Taxable Net Wage

** Work beginning after 9:00 pm on Sunday and ends on Monday is considered Monday work.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Nevada Day	Thanksgiving Day	Family Day	Christmas Day

**No work shall be permitted on Labor Day or Christmas Day under any conditions. If any holidays fall on Sunday, the Monday following shall be considered the holiday.*

JOB DESCRIPTION:

Excerpt from Agreement between DC 16 and Independent Painting Contractors of Northern Nevada, Local 567.

Covered work shall be and mean the following materials and application methods: paints, pigments, oils, turpentine, Japan dryers, thinners, varnishes, lacquers, shellac, stains, fillers, waxes, cement, joint cement, water and other vehicles; mediums that may be mixed and applied to the surfaces of materials and buildings, edifices, structures, monuments and the appurtenances thereto, of every type and description in their natural state of condition, or constructed or fabricated of any material or materials, whatsoever and provided; work or services pertaining to: the application texture, acoustic, plaster and stucco materials, incidental repairs, of all types and thickness on all surfaces and all such scope and application under the applicable Nevada Contractor License Classifications.

Painting, of all drywall and thin wall type surfaces, flushing or concrete surfaces, caulking and sealants between sheetrock walls and/or ceilings and floors of other materials.

Application of wallpapers, wall fabrics and all types of coverings or coatings whether decorative or protective and all preparations necessary before said application.

Application of protective coatings or products of similar nature whether they are plastic, vinyl, acrylics, epoxies, esters, urethans, etc., or any new products of this nature including the application to floor surfaces.

Applications of bond breaker, water repellant, damp proofing and/or waterproofing materials of all types.

Finishing and surface preparation on all hardwood or softwood floors and furniture at jobsites.

Priming and finish coats on fabricated metal or steel products.

Application of all fire retardant, fireproofing and/or insulation materials used on structural items or as architectural finishes.
Cleaning, polishing and refinishing of metal and masonry surfaces. “Steeplejack work”.
Preparation and decoration of all types; including drywall repairs and incidental repair related skimming, abrasive blasting, steam cleaning, building washing, hydro blasting, water blasting and the methods used in the removal of previously painted surfaces; including caulking, tuck pointing, spackling and wood dough work.
Application of hypolan, neoprene, and all similar products.
Llead removal and encapsulation.
Painting of lines, arrows, bumpers, curbs, etc.; on parking lots, airfields, highways, game courts (both indoor and outdoor) and other such surfaces; installation and maintenance thereof, including lines of metal, plastic or composition materials used instead of paint.
All products and methods of application which have or may be awarded to the Painters International through jurisdictional procedures.

Craft: PILE DRIVER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Pile Driver-Journeyman	$68.92
Pile Driver-Welder	$69.92
Pile Driver-Foreman	$73.28
Pile Driver-General Foreman	$78.08
Tender	$73.28
Stand-By Diver	$74.28
Diver-Diving (Wet Pay)	$123.27

ADD ZONE RATE:

In addition to PILE DRIVER rates, add the applicable amounts per hour calculated based on road miles from the Washoe County Courthouse.

Zone 1	Within 75 road miles	$0.00
Zone 2	Between 75 to 150 road miles	$6.00
Zone 3	Between 150 to 300 road miles	$7.00
Zone 4	In excess of 300 road miles	$8.00

**Workers performing outside of the free zones shall receive the appropriate remote area allowance for not less than eight (8) hours per day. Remote area differential shall be considered part of the basic wage rate for the purpose of computing overtime hourly wage rates. When the contractor furnishes daily transportation to the workers from Reno or Carson City to and from the jobsite, no travel time, subsistence, or remote area shall be paid. The workers will travel one way during regular working hours and one way outside of regular.*

****Overtime and Double Time are paid on the total Taxable Wage (base rate).**

JOB DESCRIPTION (Copied from O*NET OnLine):

Move hand and foot levers of hoisting equipment to position piling leads, hoist piling into leads, and position hammers over pilings.
Move levers and turn valves to activate power hammers, or to raise and lower drophammers that drive piles to required depths.
Drive pilings to provide support for buildings or other structures, using heavy equipment with a pile driver head.
Conduct pre-operational checks on equipment to ensure proper functioning.
Clean, lubricate, and refill equipment.
Controlling Machines and Processes — Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).
Operating Vehicles, Mechanized Devices, or Equipment — Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or watercraft.
Inspecting Equipment, Structures, or Materials — Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.
Handling and Moving Objects — Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.
Repairing and Maintaining Mechanical Equipment — Servicing, repairing, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.
Operate cranes, hoists, or other moving or lifting equipment.
Operate heavy-duty construction or installation equipment.
Position structural components.
Inspect equipment or tools to be used in construction or excavation.
Clean equipment or facilities.

Craft: PLASTERER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Plasterer-Journeyman	$61.37
Plasterer-Foreman	$65.79

ADD ZONE RATE:

In addition to PLASTERER rates, add the applicable amounts per hour, calculated from South Virginia and Mill Street, Reno, Nevada:

Zone 1	0 to 70 miles	$0.00
Zone 2	70 miles and over	$8.00

ADD PREMIUM PAY:

One and one-half (1.5) times the regular straight time hourly rate shall be paid for the first two (2) hours worked over eight (8) hours Monday through Friday, and for the first ten (10) hours on Saturday. Double (2x) the regular straight time rate shall be paid for all hours worked over ten (10) hours Monday through Saturday. All hours worked on Sundays and holidays shall be paid at double (2x) the regular straight time rate.

****All Overtime is to be calculated on the base rate of pay.**

WORKWEEK: Five (5) consecutive days of eight (8) consecutive hours (exclusive of a meal period), Monday through Friday. There shall be an eight (8) hour rest period between shifts. In the event an employee does not receive an eight (8) hour break between shifts, the employee shall remain in overtime status until they receive an eight (8) hour break.

ADDITIONAL PREMIUM PAY:

Nozzle Man w/Certification	$2.50 above base rate
First Rodman	$1.50 above base rate
High Time	$2.50 above base rate

SHIFT DIFFERENTIAL:

Second shift (Swing)	Paid at 6.5% over the regular rate
Third Shift (Graveyard)	Paid at 13% over the regular rate

**Multiple shifts may be established for three (3) or more consecutive working days. The Friday graveyard shift ending on Saturday morning will be considered Friday work. The Saturday graveyard shift ending on Sunday morning will be considered Saturday work. The Sunday graveyard shift ending on Monday morning will be considered Sunday work*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Nevada Day	Thanksgiving Day	Family Day	Christmas Day

**If any holidays fall on Sunday, the Monday following shall be considered the holiday.*

JOB DESCRIPTION:

Excerpt from the Operative Plasters' & Cement Masons' Northern Nevada OP&CMIA Local 797 Master Labor Agreement, includes but is not limited to:

All building construction, including but not limited to the construction, erection, alteration, repair, modification, demolition, addition, or improvement in whole or in part of any building structures.

All interior or exterior plastering construction, restoration, repair and inspection of cement, stucco, stone imitation or any patent material when ornamental molded plaster, and the setting of same. All specialty finishes such as veneer, venetian, marmoreno and grasello. All custom and specialty finishes, including but not limited to custom rock, carved plaster, brick and block veneer, stone and wood. Smooth and finish surfaces of full system E.I.F.S. including sticking and shaping of foam pieces or surfaces by adhesive or mechanical installation. All spray or toweled on fireproofing, including cementitious and intumescent products. All plaster acoustical finish systems including, but not limited to, BASWA Phon and Fellert.

Craft: PLUMBER/PIPEFITTER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Plumber/Pipefitter-Journeyman	$87.10
Plumber/Pipefitter-Foreman	$92.44
Plumber/Pipefitter-General Foreman	$97.78

ADD ZONE RATE:

In addition to PLUMBER/PIPEFITTER rates, add the applicable amounts per hour per statute air mile radius from the Nevada freeway interchange of Interstate 80 and 580.

Zone 1	0 to 75	$0.00
Zone 2	Over 75 miles	$8.00

**A separate free zone will be established for employees permanently residing and working within a seventy-five (75) statute air mile radius of the Elko, Nevada Post Office*

ADD PREMIUM PAY:

Normal start time is between 5:00 am and 8:00 am. The first two (2) hours of overtime and work on Saturdays to be paid at one and one-half (1.5) the straight time rate. After the first two (2) overtime hours, Sundays, holidays, and all hours worked over twelve (12) shall be paid at double time (2x).

****Overtime and Double Time shall be calculated on the straight time rate of pay, base rate.**

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	July 4th	Friday before Labor Day
Labor Day	Nevada Admission Day	Thanksgiving Day	Friday after Thanksgiving Day
Day Before Christmas	Christmas Day		

**If a holiday falls on Saturday it shall be observed the preceding Friday; if a holiday falls on Sunday, it shall be observed the following Monday.*

JOB DESCRIPTION:

Excerpt from Agreement between LU 350 of United Assoc. of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of United States and Canada.

Installation of all heating and refrigeration systems and competent parts thereof, including fabrication, assembling, erection installation, dismantling, repairing, reconditioning, adjusting, altering servicing, handling, distributing, and tying on all piping materials appurtenances and equipment by method, including all hangars and supports of every description, all other work including the trade relevant to oil burner and all other types of heating and refrigeration equipment including low voltage controls.

Craft: REFRIGERATION MECHANIC (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Refrigeration-Journeyman	$74.14
Refrigeration -Foreman	$78.78
Refrigeration -General Foreman	$83.41

ADD ZONE RATE:

In addition to REFRIGERATION MECHANIC rates, add the applicable amounts per hour per statute air mile radius from the Nevada freeway interchange of Interstate 80 and 580.

Zone 1	0 to 75	$0.00
Zone 2	Over 75 miles	$8.00

**A separate free zone will be established for employees permanently residing and working within a seventy-five (75) statute air mile radius of the Elko, Nevada Post Office*

ADD PREMIUM PAY:

Normal start time is between 5:00 am and 8:00 am. The first two (2) hours of overtime and work on Saturdays to be paid at one and one-half (1.5) the straight time rate. After the first two (2) overtime hours, Sundays, holidays, and all hours worked over twelve (12) shall be paid at double time (2x).

****Overtime and Double Time shall be calculated on the Taxable Income (base rate).**

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	July 4th	Friday before Labor Day
Labor Day	Nevada Admission Day	Thanksgiving Day	Friday after Thanksgiving Day
Day Before Christmas	Christmas Day		

**If a holiday falls on Saturday, it shall be observed the preceding Friday; if a holiday falls on Sunday, it shall be observed the following Monday.*

JOB DESCRIPTION:

Excerpt from Agreement between LU 350 of United Assoc. of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of United States and Canada.

Installation of all heating and refrigeration systems and competent parts thereof, including fabrication, assembling, erection installation, dismantling, repairing, reconditioning, adjusting, altering servicing, handling, distributing, and tying on all piping materials appurtenances and equipment by method, including all hangars and supports of every description, all other work including the trade relevant to oil burner and all other types of heating and refrigeration equipment including low voltage controls.

Craft: ROOFER (Union Rate)
(Does not include sheet metal roofs)
Prevailing wage rates include the base rate as well as all applicable fringes

Roofer-Journeyman (A Journeyperson of a three (3) person crew or more shall be designated a Foreman.)	$55.43
Roofer-Foreman (The Foreman's wage shall be twenty percent (20%) over a Journeyperson's base wage.)	$63.73

**A Journeyperson of a three (3) person crew or more shall be designated a Foreman.*

ADD PREMIUM PAY:
Any work performed in excess of ten (10) hours per day or forty (40) hours per week shall be paid at the rate of one and one-half (1.5) times the regular straight time rate of pay. Two times (2x) the regular wage shall be paid for all work performed on Sundays. Two times (2x) the regular wage shall be paid for work performed on a Holiday.

REGULAR WORKDAY: The regular workday shall be eight to ten (8 to 10) hours plus a half (1/2) hour unpaid lunch.

REGULAR WORKWEEK: The regular workweek shall be a forty (40) hour flexible schedule, Monday through Saturday. The regular workday shall start as scheduled by the employer.

****Overtime and Double Time are calculated on the base rate of pay.**

RECOGNIZED HOLIDAYS:

New Year's Day	Presidents' Day	Memorial Day	Independence Day
Labor Day	Veterans Day	Thanksgiving Day	Friday after Thanksgiving
Christmas Eve	Christmas Day		

**If a designated holiday falls on Saturday, it shall be observed on the preceding Friday as a day off; a holiday falling on Sunday shall be observed on the following Monday as a day off; a holiday falling on Tuesday, Wednesday, or Thursday shall be observed on that day.*

JOB DESCRIPTION:
Excerpt from Roofers, Waterproofers, and Allied Workers Local 162.

All slate where used for roofing of any size, shape or color, used in any manner laid, including flat or promenade slates, with necessary metal flashing to make water-tight.
All tile where used for roofing of any size, shape or color, used in any manner laid, including flat or promenade tile, with necessary metal flashing to make watertight.
All asbestos shingles where used for roofing of any size, shape or color, and in any manner, laid with necessary metal flashing to make watertight.
All cementing in, on or around the said slate or tile roof or promenade.
All laying of felt, paper, membranes, ice shields, vapor barriers or similar underlayments on substrates.
All dressing, punching and cutting of all roof slate or tile.
All operation of slate cutting or punching machinery.
All substitute material taking the place of slate or tile, as asbestos slate or tile, cement or composition tile, including shingles of composition wood and metal tile.
All removal of slate or tile roofing as defined above when a roof is to be reapplied in their place.
All solar or photovoltaic cell-type roofing systems used to transform solar energy to electrical energy.
All organic or inorganic felts and fabrics that comprise the reinforcing membrane of built-up roofing and waterproofing systems.
All waterproofing using bituminous products whether structures are above or below grade.
All forms of plastic, slate, slag, gravel, or rock roofing, including all types of aggregates, blocks, bricks, stones or pavers used to ballast or protect Inverted Roof Membrane Assembly (IRMA) roofs, or roofs of similar construction where the insulation is laid over the roof membrane.
All kinds of asphalt and composition roofing and waterproofing.
All base flashings, curb flashings, and counter flashings of bituminous composition used to roof or waterproof intersections of horizontal surfaces.
All components of composition roofing systems used to seal the roof, including but not limited to compression seals, termination bars, lath, roof cement and reinforcements, caulking and sealants.
All kinds of coal tar pitch and coal tar bitumen roofing and waterproofing.
All cleaning, preparing, priming and sealing of roof decks and surfaces that receive roofing, dampproofing and/or waterproofing.
All rock asphalt and composition roofing.
All rock asphalt mastic when used for damp and waterproofing.
All prepared paper roofing.
All mineral surfaced roofing, including 90lb., and 818, whether nailed, mopped with bitumen, or applied with mastic or adhesive.
All compressed paper, chemically prepared paper, and burlap when used for roofing or damp and waterproofing purposes, with or without coating.

All substrates used on the roof deck for fireproofing or any materials used as a support or nailing surface for the roofing system over the deck.
All damp resisting preparations when applied with a mop, brush, roller, swab, trowel, or spray system inside or outside of structure.
All damp course, sheeting or coating on all foundation work.
All tarred floors.
All wood block floors that are set in and/or coated with bituminous products.
All waterproofing of shower pans and/or stalls.
All laying of tile, wood block or brick, when laid in pitch, tar, asphalt mastic, marmolite, or any form of bituminous products.
All forms of insulation used as part of, or in connection with, roofing, waterproofing or dampproofing.
All forms of composite insulations having nailable surfaces (e.g. plywood, pressboard, chipboard, drywall, or other laminates) bonded to the insulation wherever such composite insulations are used as an integral thermal insulating component of the roofing system.
All forms of protection boards, walkway pads and roof treads used in composition roofing or waterproofing to protect the membrane from damage.
All types of coatings, toppings and finishes used on the roof surfaces.
All solar or photovoltaic cell-type structures that are used as substitutes for ballast or membrane protection.
All solar or photovoltaic cell-type roof membrane systems used to transform solar energy to electrical energy.
All forms of elastomeric and/or plastic (elasto-plastic) roofing systems, both sheet and liquid applied, whether single-ply or multi-ply. These shall include but not limited to:

a. PVC (polyvinyl chloride systems)
b. Butyl Rubber
c. EPDM (Ethylene-propylene diene monomer)
d. PIB (polyisobutylene)
e. CPE (chlorinated polyethylene)
f. CSPE (chlorosulfonated polyethylene)
g. Modified bitumens
h. TPO Membrane (Thermo Plastic Olefin)

All sealing and caulking of seams and joints on these roofing systems by heat or solvent welding or by adhesives or butyl tapes or any other means.
All base flashings, curb flashings and counter flashings of elasto-plastic composition as outlined.
All components of elasto-plastic roofing systems used to seal the roof including but not limited to, compression seals, termination bars, caulking and sealants.
All insulations applied with the above systems, whether laid dry, mechanically fastened, or attached with adhesives, to include any gypsum board and/or fire barrier required.
All forms of composite insulations having nailable surfaces (e.g. plywood, chipboard, drywall, or other laminates) bonded to the insulation wherever such composite insulations are used as an integral thermal insulating component of the roofing system.
All types of aggregates, blocks, bricks, stones, or units of photovoltaic cell construction used to ballast these elasto-plastic systems.
All types of aggregates, blocks, stones, pavers or units of photovoltaic cell construction used to ballast or protect Inverted Roofing Membrane Assembly (IRMA) roofs, or roofs of similar construction where the insulation is laid over the roof membrane.
All sealing and caulking of seams and joints on these elasto-plastic systems to ensure water-tightness.
All liquid-type elasto-plastic preparations for roofing, damp or waterproofing when applied with a squeegee, trowel, roller or spray equipment, whether applied inside or outside of the building.
All sheet-type, elasto-plastic systems, whether single or multi-ply for waterproofing either inside or outside of a building.
All cleaning, preparing, priming and sealing of surfaces to be roofed, dampproofed or waterproofed, whether done by roller, mop, swab, three-knot brush, squeegee, spray systems, or any other means of application.
All types of pre-formed panels and rolls used in waterproofing (Volclay, Bentonite etc.)
All applications of protection boards to prevent damage to the dampproofing or waterproofing membrane by other crafts or during back-filling operations.
All handling of roofing, damp and waterproofing materials.
All hoisting and storing of roofing, damp and waterproofing materials.
All types of spray-in-place foams such as urethane, polyurethane, or polyisocyanurate, the machinery and equipment used to apply them, and the coatings that are applied over them.
All types of resaturants, coatings, mastics and toppings when used for roof maintenance and repairs.
All wrapping and/or coating of underground pipelines with bitumastic enamel or cold process, polykin tape, tapecoat, or other asphaltic coatings or tape inside or outside of pipe, whether done by roller, mop, swab, three-knot brush, or spray systems. Preparation of surface by sand blasting or wire brushing.
All operation of jeeper or holiday detectors.
All Zonolite or Cellular Concrete Roof Insulation and all materials, the machinery and equipment used to apply them.
All materials laminated to roofing and/or insulation systems.

Craft: SHEET METAL WORKERS (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Sheet Metal Worker Journeyman	$83.70
Sheet Metal Worker Foreman	$88.96
Sheet Metal Worker General Foreman	$94.22

ADD ZONE RATE:

In addition to SHEET METAL WORKER rates, add the applicable amounts per hour, calculated based on a road from the courthouse in Reno, Nevada:

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 100 miles	$5.00
Zone 3	Over 100 miles	$10.00 (Employee shall be provided reasonable lodging and meal expenses.)

**A separate free zone will be established for employees permanently residing and working within a seventy-five (75) mile radius of the Elko, Nevada Post Office.*

ADD PREMIUM PAY:

All work performed outside the regular working hours and performed during the regular work week, shall be at one and one-half (1.5) times the regular rate. The first eight (8) hours worked on Saturday shall be paid at one and one-half (1.5) times the regular rate. All work after ten (10) continuous hours, all hours worked beyond eight (8) on Saturday, and all hours worked on Sundays and holidays will be compensated at double (2x) the regular rate.

****Overtime and Double Time are calculated on the base rate of pay.**

WORKDAY & WORKWEEK: Regular working day is between 6:00 am and 4:30 pm Monday through Friday. At the employer's discretion a regular work week, may include ten (10) hour days at four (4) days per week.

SHIFT DIFFERENTIAL:

First shift (Day)	Begin at 6:00 am and end at 4:30 pm	Standard hourly wage
Second shift (Swing)	Start Time 4:00 p.m.	Additional 10% to the taxable wage
Third shift (Graveyard)	Start Time 12:00 a.m.	Additional 15% to the taxable wage

**Three or more consecutive days. When a second shift (evening) is required, the second shift may start any time following the day shift. If the second shift extends past midnight, the entire second shift shall be paid at the graveyard shift rate. When three (3) shifts are required, the graveyard shift will begin at 12:00 am on Monday. The day shift shall begin at 6:00 am and end at 4:30 pm. The evening shift will begin at 4:00 pm on Monday.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Friday before Labor Day
Labor Day	Nevada Day	Thanksgiving Day	Day after Thanksgiving
Day before Christmas	Christmas Day		

**Or days locally observed as such, and Sunday shall be recognized as holidays. If a holiday falls on Saturday, it shall be recognized on the preceding Friday; if a holiday falls on Sunday, it shall be recognized the following Monday*

JOB DESCRIPTION:

Excerpt from Sheet Metal Local 26 Collective Bargaining Agreement.

Manufacture, fabrication, assembling, handling, erection, installation, dismantling, conditioning, adjustment, alteration, repairing and servicing of all ferrous or nonferrous metal work and all other materials used in lieu thereof and of all HVAC systems, air veyor systems, exhaust systems, and air-handling systems regardless of material used including the setting of all equipment and all reinforcements in connection therewith; all lagging over insulation and all duct lining; testing and balancing of all air-handling equipment and duct work; the preparation of all shop and field sketches whether manually drawn or computer assisted used in fabrication and erection, including those taken from original architectural and engineering drawings or sketches; metal exterior wall systems, metal roofing; and all other work included in the jurisdictional claims of International Association of Sheet Metal, Air, Rail and Transportation Workers.

Craft: SOILS and MATERIAL TESTER (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Soils and Materials Tester	$52.91

Craft: SPRINKLER FITTER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Sprinkler Fitter-Journeyman	$90.47
Sprinkler Fitter-Foreman	$93.97
Sprinkler Fitter-General Foreman	$96.22

ADD ZONE RATE:

In addition to SPRINKLER FITTER rates, add the applicable amounts per day. Zone Pay shall be determined by reference to maps.google.com from the residence of the employee to the job site, and shall be paid per day as follows:

Zone 1	0 to 60 miles	$0.00
Zone 2	60-80 miles	$30.00
Zone 3	80-100 miles	$39.00
Zone 4 (Subsistence Pay)	Over 100 miles	$150.00

ADD PREMIUM PAY:

All overtime, except for Sundays and holidays, shall be at the rate of time and one-half (1.5). Time worked on Sundays and holidays shall be double (2x) the regular rate of pay.

STANDARD WORKDAY AND WORKWEEK: Eight (8) consecutive hours of work between 6:00 a.m. and 6:00 p.m. Monday through Friday.

****Overtime and Double Time are calculated on the base rate of pay.**

SHIFT DIFFERENTIAL:

Second & Third Shifts (Swing/Graveyard)	6:00 p.m. to 6:00 a.m.	15% above base hourly rate
Shift work may only be performed on the same job site and must continue for five (5) consecutive workdays. Eight (8) hours of work constitutes a shift. There shall be at least two (2) men on each shift. It shall not be required to work a day shift to work a second and/or third shift under this paragraph. Shift work shall only be considered if it has 5 consecutive days; anything less will be considered overtime rate of pay.		

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Thanksgiving Day	Christmas Day		

**When a holiday falls on a Sunday, the following Monday shall be considered the holiday; when a holiday falls on Saturday, the preceding Friday shall be considered the holiday.*

JOB DESCRIPTION:

Excerpt from between National Fire Sprinkler Association and Road Sprinkler Fitters Local 669.

Installing, dismantling, maintenance, repairs, adjustments and corrections of all fire protection and fire control systems Including the unloading, handling by hand, power equipment and installation of all piping or tubing, appurtenances and equipment pertaining thereto, including both overhead and underground water mains, fire hydrants and hydrant mains, standpipes, and hose connections to sprinkler systems, sprinkler tank heaters, air lines and thermal systems used in connection with sprinkler and alarms systems, also all tanks and pumps connected thereto. Also including shall be CO2 and Cardox Systems, Dry Chemical Systems, Foam Systems and all other fire protection systems, but excluding steam fire protection systems.

Craft: SURVEYOR (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes.

Rodman/Chainman	$72.97
Chief of Party Surveyor	$75.69

ADD PREMIUM PAY:

One and one-half (1.5) times the applicable straight-time rate for all work performed before a shift begins and after it ends, and for all Saturday work in excess of forty (40) hours in one (1) work week. Double (2x) the applicable straight time rate after twelve (12) hours in any one shift. Any work performed on Sundays and holidays shall be paid at two (2) times the applicable straight time rate.

****Overtime and Double Time are calculated on the base rate/Taxable Income.**

SHIFT DIFFERENTIAL:

Night shifts	all shifts starting between 4:00 pm and 4:00 am	Shall be paid twelve and one-half percent (12.5%) differential in addition to his/her regular pay

RECOGNIZED HOLIDAYS:

New Year's Day	Presidents' Day	Memorial Day	Independence Day
Labor Day	Nevada Admission Day	Thanksgiving Day	Day after Thanksgiving Day
Christmas Day			

**Holidays falling on Sunday shall be observed the following Monday, holidays falling on Saturday shall be observed the preceding Friday.*

JOB DESCRIPTION:

Excerpt from Operating Engineers Local 3 Agreement, includes but is not limited to:

1. Planning ground surveys designed to establish base lines, elevation and other geodetic measurements;
2. Compiling data relevant to the shape, contour, gravitation, location, elevation and dimension of land and land features on or near the surface of the Earth for engineering, map making, mining, land evaluation, construction and other purposes;
3. Surveying bodies of water to determine navigable channels and to secure data for construction of breakwaters, piers and other marine structures;
4. Computing data necessary for driving and connecting underground passages, underground storage and volume of underground deposits.

Craft: TAPER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Taper-Journeyman	$67.36
Taper-Foreman	$71.96

ADD ZONE RATE:

In addition to TAPER rates add the applicable amounts per day calculated based on road miles from the Washoe County Courthouse.

Zone 1	0 to 70 miles	$0.00
Zone 2	Over 70 miles	$75.00

**Excludes the City limits of Fallon and the Fallon NAS.*

ADD PREMIUM PAY:

The first four (4) hours worked outside a regular five (5) day eight (8) hour constituted day shift, Monday through Friday, shall be paid at the rate of one and one-half (1.5) times the straight time rate. All hours worked beyond twelve (12) hours shall be paid at two (2X) times the straight time rate. The first ten (10) hours worked on a Saturday shift shall be paid at the rate one and one-half (1.5) times the straight time rate all other hours worked beyond the ten (10) hours shall be paid at double (2X) the straight time rate. Hours worked on Sunday and recognized holidays shall be paid at the rate of two times (2X) the straight time hourly rate. Any work beginning after 9:00 pm on Sunday that ends on Monday shall be considered Monday work. Any hours worked prior to 9:00 pm Sunday would be considered Sunday work and shall be paid at two (2) times the regular straight time rate of pay.

When working a four-10 (4-10) hour shift, hours worked beyond ten (10) and before twelve (12) hours shall be paid at one and one-half (1.5) the straight time rate; all hours beyond shall be paid at two (2X) time the straight time rate. The first ten (10) hours worked on the fifth (5th) or sixth (6th) day shall be paid at one and one-half (1.5) the straight time rate; all other hours at double (2X) the straight time rate. A four-ten (4-10) hour shift will be four (4) straight days, Monday through Thursday, or Tuesday through Friday.

***Overtime and Double Time are calculated on the base rate of pay.**

WORKWEEK: The regular workweek shall consist of five (5) eight (8) hour workdays, or four (4) consecutive ten (10) hour workdays between Monday through Friday between 6:00 am and 6:00 pm.

SHIFT DIFFERENTIAL:

First shift (Day)	8:00 a.m. to 4:30p.m.	Eight (8) hours at the regular rate of wages
Second shift (Swing)	4:30 p.m. to 12:01 a.m.	Seven (7) hours work for eight (8) hours pay at the regular rate of wages.
Third shift (Graveyard)	12:30 a.m. to 7:30 a.m.	Six and one-half (6.5) hours work for eight (8) hours pay at the regular rate of wages.

**Shift work shall be for a minimum of five (5) consecutive days, Monday through Friday, of which one (1), two (2), or three (3) of the above shifts may be worked.*

High Pay (Over 40 feet)	Work on an elevated, mechanically operated platform (including but not limited to: swing stage, boatswain chair, crane basket, heck lift) or rappelling work	Additional 10% per hour above the base

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Nevada Day	Thanksgiving Day	Family Day	Christmas Day

**No work shall be permitted on Labor Day or Christmas Day under any circumstances. Holidays falling on a Saturday shall be observed the prior Friday. Holidays falling on Sunday, the Monday following shall be observed.*

JOB DESCRIPTION:

Excerpt from Agreement between DC 16 and the independent Drywall Contractors of Northern Nevada (Local 567).

Shall include (but not be limited to) all work operations, including distribution to the point of application, as follows:
(a) Work or services pertaining to the preparation, spotting, pointing, detailing, flushing, sanding and finishing of interior and/or exterior gypsum, drywall, thin wall, concrete, steel, wood and plaster surfaces, spackling of all surfaces where adhesive materials are used; and all drywall pointing, taping and finishing.

(b) Work or services pertaining to the application of all finish or flushing materials regardless of method of application or type of surface on which materials are applied, including but not limited to texture and simulated acoustic materials of all types and the application of radiant heat fill and steel fireproofing materials.
(c) Work or services pertaining to the installation of protective coverings and masking prior to the application of finish materials.
(d) The operation and care of all taping tools and texturing equipment used in the finishing and texturing of drywall and other surfaces including brushes, rollers, spray texturing equipment, miscellaneous hand, mechanical, and power tools, and the operation and maintenance of compressors required in the finishing and texturing of such surfaces.
(e) No limitation shall be placed on the work by reason of the surface, type of material or purpose for which the materials used are designed or intended.
(f) The cleanup of all materials and debris occasioned by any job operation at the site of construction, alteration, or repair undertaken whether such operation occurs on the interior or exterior of a building structure.

Craft: TILE SETTER/TERRAZZO WORKER/MARBLE MASON FINISHER (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Tile Setter/Terrazzo Worker/Mable Mason Finisher	$44.85

JOB DESCRIPTION TILE FINISHER (Copied from O*NET OnLine):

- Apply a mixture of cement, sand, pigment, or marble chips to floors, stairways, and cabinet fixtures to fashion durable and decorative surfaces.
- Measure designated amounts of ingredients for terrazzo or grout, according to standard formulas and specifications, using graduated containers and scales, and load ingredients into portable mixer.
- Grind surfaces with a power grinder, or polish surfaces with polishing or surfacing machines.
- Cut metal division strips and press them into the terrazzo base for joints or changes of color to form designs or patterns or to help prevent cracks.
- Blend marble chip mixtures, place into panels, and push a roller over the surface to embed the chips.
- Modify mixing, grouting, grinding, or cleaning procedures, according to type of installation or material used.
- Spread, level, or smooth concrete or terrazzo mixtures to form bases or finished surfaces, using rakes, shovels, hand or power trowels, hand or power screeds, or floats.
- Grind curved surfaces or areas inaccessible to surfacing machine, such as stairways or cabinet tops, with portable hand grinder.
- Wash polished terrazzo surface, using cleaner and water, and apply sealer and curing agent according to manufacturer's specifications, using brush or sprayer.
- Position and secure moisture membrane and wire mesh in preparation for pouring base materials for terrazzo installation.
- Fill slight grinding depressions with matching grout material and hand-trowel for a smooth, uniform surface.
- Clean installation site, mixing and storage areas, tools, machines, and equipment, and store materials and equipment.
- Sprinkle colored marble or stone chips, powdered steel, or coloring powder over surface to produce prescribed finish.
- Wet surface to prepare for bonding, fill holes and cracks with grout or slurry, and smooth with a trowel.
- Mix cement, sand, and water to produce concrete, grout, or slurry, using hoe, trowel, tamper, scraper, or concrete-mixing machine.
- Chip, scrape, or grind high spots, ridges, or rough projections to finish concrete, using pneumatic chisel, hand chisel, or other hand tools.
- Mold expansion joints and edges, using edging tools, jointers, or straightedges.
- Move terrazzo installation materials, tools, machines, or work devices to work areas, manually or using wheelbarrow.
- Clean chipped area, using wire brush, and feel and observe surface to determine if it is rough or uneven.
- Repair concrete by cutting out damaged areas, drilling holes for reinforcing rods, and positioning reinforcing rods, using power saw and drill.
- Precast terrazzo blocks in wooden forms.
- Wet concrete surface and rub with stone to smooth surface and obtain specified finish.
- Build wooden molds, clamping molds around areas to be repaired, or setting up frames to the proper depth and alignment.
- Spread roofing paper on surface of foundation and spread concrete onto roofing paper with trowel to form terrazzo base.
- Produce rough concrete surface, using broom.
- Remove frames when the foundation is dry.
- Signal truck driver to position truck to facilitate pouring concrete and move chute to direct concrete on forms.

Craft: TILE SETTER/TERRAZZO WORKER/MARBLE MASON (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Tile Setter - Journeyman	$55.50
Terrazzo/Marble Mason - Journeyman	$57.09

JOB DESCRIPTION TILE/STONE SETTER (Copied from O*NET OnLine):

- Apply hard tile, stone, and comparable materials to walls, floors, ceilings, countertops, and roof decks.
- Align and straighten tile using levels, squares, and straightedges.
- Finish and dress the joints and wipe excess grout from between tiles, using damp sponge.
- Cut and shape tile to fit around obstacles and into odd spaces and corners, using hand and power cutting tools.
- Determine and implement the best layout to achieve a desired pattern.
- Mix, apply, and spread plaster, concrete, mortar, cement, mastic, glue or other adhesives to form a bed for the tiles, using brush, trowel and screed.
- Study blueprints and examine surface to be covered to determine amount of material needed.
- Measure and mark surfaces to be tiled, following blueprints.
- Lay and set mosaic tiles to create decorative wall, mural, and floor designs.
- Apply mortar to tile back, position the tile, and press or tap with trowel handle to affix tile to base.
- Mix and apply mortar or cement to edges and ends of drain tiles to seal halves and joints.
- Apply a sealer to make grout stain- and water-resistant.
- Level concrete and allow to dry.
- Measure and cut metal lath to size for walls and ceilings, using tin snips.
- Install and anchor fixtures in designated positions, using hand tools.
- Prepare surfaces for tiling by attaching lath or waterproof paper, or by applying a cement mortar coat to a metal screen.
- Remove and replace cracked or damaged tile.
- Cut tile backing to required size, using shears.
- Remove any old tile, grout and adhesive using chisels and scrapers and clean the surface carefully.
- Cut, surface, polish, and install marble and granite or install pre-cast terrazzo, granite or marble units.
- Spread mastic or other adhesive base on roof deck to form base for promenade tile, using serrated spreader.
- Assist customers in selection of tile and grout.
- Prepare cost and labor estimates, based on calculations of time and materials needed for project.
- Brush glue onto manila paper on which design has been drawn and position tiles, finished side down, onto paper.
- Select and order tile and other items to be installed, such as bathroom accessories, walls, panels, and cabinets, according to specifications.
- Build underbeds and install anchor bolts, wires, and brackets.

Craft: TRAFFIC BARRIER ERECTOR (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Traffic Barrier Erector (Laborer Group 1)	$56.28

ADD ZONE RATE:

In addition to TRAFFIC BARRIER ERECTOR, add the applicable amounts per hour, calculated based on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$6.00
Zone 3	150 to 300 miles	$7.00
Zone 4	300 miles or over	$8.00

**No remote area pay shall be paid within ten (10) miles of employee's permanent place of residence in the State of Nevada.*

ADD PREMIUM PAY:

One and one-half (1.5) the regular straight time hourly rate shall be paid for all time worked over eight (8) or ten (10) (if on 4/10 schedule) in one day and on Saturdays. Sundays, Holidays, and all hours worked over twelve (12) in one day are to be paid at double (2x) the regular straight time hourly rate.

WORKDAY & WORKWEEK: Single shift jobs are eight (8) consecutive hours with a starting time between 5:30 am and 8:00 am., Monday through Friday.

****Overtime and Double Time shall be calculated on the Taxable wage (base rate).**

SHIFT DIFFERENTIAL:

Second (swing) and Third (graveyard) shifts	Shall be paid a 12.5% differential

**Upon approval the Employer may utilize multiple shifts for less than five (5) consecutive days provided there is a legitimate business or bid specification requirement and the shift differential is paid.*

RECOGNIZED HOLIDAYS:

New Year's Day	Memorial Day	Independence Day	Labor Day
Admission (Nevada) Day	Thanksgiving Day	Family Day	Christmas Day

**If any of these holidays fall on Sunday, the Monday following shall be considered a holiday.*

JOB DESCRIPTION:

Excerpt from Agreement between AGC and LIUNA Local 169

1. Distributing traffic control signs and markers along site in designated pattern;
2. Informing drivers of detour routes through construction sites;

(SEE LABORERS GROUP 1)

Craft: TRUCK DRIVER (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Truck Driver	$35.79

JOB DESCRIPTION (Copied from O*NET OnLine):

Per Nevada Administrative Code 338.017, a worker who performs the craft of truck driver shall be deemed to be employed on a public work only while:

1. Transporting materials at the site of a public work; or
2. Transporting materials between the sites of a public work.

Craft: WELL DRILLER (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Well Driller	$36.42

JOB DESCRIPTION (Copied from O*NET OnLine)

Includes but is not limited to:

- Operate a variety of drills such as rotary, churn, and pneumatic to tap subsurface water and salt deposits, to remove core samples during mineral exploration or soil testing, and to facilitate the use of explosives in mining or construction. Includes horizontal and earth boring machine operators.
- Operate controls to stabilize machines and to position and align drills.
- Start, stop, and control drilling speed of machines and insertion of casings into holes.
- Regulate air pressure, rotary speed, and downward pressure, according to the type of rock or concrete being drilled.
- Select and attach drill bits and drill rods, adding more rods as hole depths increase, and changing drill bits as needed.
- Drive or guide truck-mounted equipment into position, level and stabilize rigs, and extend telescoping derricks.
- Operate machines to flush earth cuttings or to blow dust from holes.
- Verify depths and alignments of boring positions.
- Perform routine maintenance and upgrade work on machines and equipment, such as replacing parts, building up drill bits, and lubricating machinery.
- Select the appropriate drill for the job, using knowledge of rock or soil conditions.
- Document geological formations encountered during work.
- Drive trucks, tractors, or truck-mounted drills to and from work sites.
- Assemble and position machines, augers, casing pipes, and other equipment, using hand and power tools.
- Record drilling progress and geological data.
- Retrieve lost equipment from bore holes, using retrieval tools and equipment.
- Fabricate well casings.
- Pour water into wells, or pump water or slush into wells to cool drill bits and to remove drillings.
- Create and lay out designs for drill and blast patterns.
- Place and install screens, casings, pumps, and other well fixtures to develop wells.
- Operate water-well drilling rigs and other equipment to drill, bore, and dig for water wells or for environmental assessment purposes.
- Review client requirements and proposed locations for drilling operations to determine feasibility, and to determine cost estimates.
- Drill or bore holes in rock for blasting, grouting, anchoring, or building foundations.
- Perform pumping tests to assess well performance.
- Disinfect, reconstruct, and redevelop contaminated wells and water pumping systems, and clean and disinfect new wells in preparation for use.
- Design well pumping systems.
- Signal crane operators to move equipment.
- Withdraw drill rods from holes, and extract core samples.
- Inspect core samples to determine nature of strata, or take samples to laboratories for analysis.
- Retract augers to force discharge dirt from holes.
- Monitor drilling operations, by checking gauges and listening to equipment to assess drilling conditions and to determine the need to adjust drilling or alter equipment.

GROUP CLASSIFICATIONS

LABORER

LABORER, INCLUDES BUT IS NOT LIMITED TO:

Group 1

- All cleanup work of debris, grounds, and building including windows and tile
- Dumpmen or Spotter (other than asphalt)
- Handling and Servicing of Flares, Watchmen
- General Laborer: Shall include, but is not limited to, various construction and support, work processes and tasks, necessary for the economic and efficient completion of the construction work being performed not listed in any other Group
- Stocking and scrapping drywall, metal studs and related materials
- Tending to Carpenters, handling and distributing materials used by Carpenters
- Tending to portable space heaters
- Profilograph work all types manual, self propelled or carts Gab ion basket, building, handling, installation, and rigging
- Dry set paver work
- Guide Posts and Highway Signs
- Guardrail Erection and Dismantling
- Limber, Brushloader and Piler
- Traffic Barrier Erector
- Solar Laborer

Group 1A

- Flaggers

Group 2

- Choker setter or Rigger (clearing work only) Pittsburg
- Chipper and similar type brush shredders
- Concrete worker (wet or dry) all concrete work not listed in Group III
- including but not limited to: concrete farms stripping, handling, cleaning, oiling and moving to the next point of installation
- Waterproofing work
- Epoxying rebar/dowels and anchoring dowel baskets
- Placement/pouring of concrete including any epoxy resin or similar materials, rodding, spreading and tamping concrete, brooming or brushing, hand application of curing compounds, applying topping (wet or dry) colors or grits, and exposed finishes for architectural work
- Concrete patching, dry packing, chipping, stoning, and grouting,
- Concrete cold whether/rain protection and curing (except in cases of emergency)
- Placement/anchoring of all earth stabilization/filter fabrics
- Mechanically Stabilized Earth (MSE) and Keystone type retaining walls rigging, placing, aligning, backfilling and installation of dead men and any other stabilization components
- Crusher or Grizzly Tender
- Greasing Dowels
- Guinea Chaser (Stakemen)
- Panel forms (wood or metal) handling, cleaning and stripping of
- Loading and unloading, Carrying and handling of all rods and material for use in reinforcing concrete
- Railroad Trackmen (maintenance, repair or builders)
- Sloper

Group 3

- Asphalt Workers (Ironers, Shovelers, Cutting machine)
- Buggymobile
- Chainsaw, Faller, Logloader and Bucker
- Compactor (all types)
- Fence erector including safety, chain link, turtle, field and barbed wire fencing
- Concrete Mixer under ½ yard
- Concrete Pan Work (Breadpan type), handling, cleaning, stripping

- Concrete; Saw cutting and coring all types, Chipping, bush hammering,
- Grinding, Sanding, Vibrator, Epoxy Type Injection pumps
- Cribbing, Shoring, Lagging, Trench Jacking, Hand-Guided Lagging Hammer
- Curbing or Divider machine
- Curb Setter (precast or cut)
- Ditching Machine (hand-guided)
- Drillers Helper, Chuck Tender
- Form Raiser, Slip Forms
- Grouting of Concrete Walls, Windows and Door Jambs
- Headerboardmen
- Jackhammer, Pavement Breaker, Air Spade
- Mastic Worker (wet or dry)
- PipeWrapper, Kettlemen, Potmen, and Laborers applying asphalt, creosote and similar type materials
- All Power Tools (air, gas, or electric),
- Post Driver
- Riprap-Stonepaver and RockSlinger, including placing of sack concrete wet or dry Rototiller
- All Laborers work in conjunction with enviromats and similar type erosion control products
- Rigging and Signaling in connection with Laborers' work
- Sandblaster, Potmen, gunmen or Nozzlemen, water blasting not covered in Group 5A
- Vibra-screed
- All demolition and wrecking work including but not limited to any torch work cutting, burning, plasma arc, dust control, and salvaging (removing and salvaging of all materials, windows, doors, plumbing and electrical fixtures) and use of customary tools and equipment for demolition and wrecking
- All underpinning foundation work, digging of underpinning pits, removal of debris with tuggers or by other methods, cutting, handling and installing all shoring boards and lagging boards used for underpinning and foundation work, placement and tying of steel reinforcing for underpinning piers, all tiebacks and soil nail work drilling and grouting, all soldier beam work and use of customary tools and equipment for underpinning foundation work.

Group 3A

- Concrete Specialist
- Setting screeds
- Screed pins
- Curb forms and curb and gutter forms,
- Using Darby and push floats,
- Hand trowels or hand floating
- Marking edging
- Using base cove or step tools
- Spreading and finishing gypsum
- Concrete grinding machines (the terms does not include Rotomill machines for highway overlay grinding)
- Troweling machines
- Floating machines
- Finishing of epoxy or resin materials
- Operation of skill saw
- Laser Screed
- Laser Level
- Curb and Slipform machines
- Stamps or other means or texturing,
- Any new devices which are beneficial to the construction of or with concrete or related products.

Group 4

- Burning and Welding in connection with Laborers' work
- Joy Drill Model TWM-2A, Gardner Denver Model DN143 and similar type drills (in accordance with Memorandum of Understanding between Laborers and Operating Engineers dated at Miami, Florida, Feb. 3, 1954) and Track Drillers, Diamond Core Drillers, Wagon Drillers, Mechanical Drillers on Multiple Units

- High scalers including but not limited to laying, anchoring, pinning, cabling and stretching of any rock fall netting, mesh or wire fabric and use of customary tools and equipment for high scaling
- Concrete pump operator
- Heavy Duty Vibrator with Stinger 5" diameter or over
- Pipelayer, Caulker and Bander
- Pipelayer-waterline, Sewerline, Gasoline, Conduit and all other types of composition for any purpose buried under ground outside of building including, stringing, trench shoring, backfilling sanding, caution taping, all walk behind equipment and spotting
- Laborer work in connection with micro tunneling, directional drilling and pipe-jacking
- Cathodic protection, grounding for pipe work
- Cleaning of Utility Lines
- Slip Lining of Utility Lines (including operation of Equipment)
- TV Monitoring and Grouting of Utility Lines
- Asphalt Rakers and Asphalt dump Man
- All mechanical and pressurized pipe work, including the installation of pipe above and below ground, cathodic protection, bolt up, and support installation in connection to water conveyance, production, purification, filtration and treatment facilities

Group 5

- Construction Specialists
- Blasters and Powdermen, all work of loading, placing, and blasting of all powder and explosives of any type, regardless of method used for such loading and placing Asbestos removal
- Lead abatement
- Hazardous waste
- Material removal
- Traffic Control Supervisor

Group 5A

- Pavement Marking and Highway Striping
- Pavement Marking and Highway Striping Foreman
- Pavement Marking and Highway Striping work includes but is not limited to: All work by any method preformed in connection with the permanent or temporary application and installation of pavement marking of any kind, brand, type or style on parking lots, airfields, highways, streets and other such surfaces and all work performed in connection with removal of pavement marking, highway striping, and traffic control devices.
- Work in conjunction with the installation and erection of all permanently affixed road signs, monument markers, parking lot signs and parking delineating barricades, and car stops

Group 6

- Gunite Foremen, Nozzlemen, Rodmen, Gunmen, Materialmen, Reboundmen
- Tunnel and shaft workers/miners and use of customary tools and equipment for tunnel and mine work
- All worked performed in a compressed air tunnel shaft or chamber including the use of hand, power tools or equipment as necessary in connection with compressed air work

OPERATING ENGINEER, INCLUDES BUT IS NOT LIMITED TO:

Group 1
- Engineer Assistant

Group 1A
- Oiler (Construction)
- Partsman (heavy duty repair shop parts room when needed)

Group 2
- Compressor Operator
- Material Loader and/or Conveyor Operator (handling building materials)
- Pump Operator

Group 3
- Bobcat or similar loader, 1/4 cu. yd. or less
- Concrete Curing Machines (streets, highways, airports, canals)
- Conveyor Belt Operator (tunnel)
- Forklift (under 20ft)
- Engineer Generating Plant (500 K.W.)
- Mixer Box Operator (concrete plant)
- Motorman
- Rodman/Chainman
- Rotomist Operator
- Oiler (truck crane)

Group 4
- Concrete Mixer Operator, Skip type
- Dinky Operator (Assistant to Engineer required)
- Forklift (20' or over) or Lumber Stacker
- Ross Carrier
- Skip Loader Operator (under one (1) cu. yd.)
- Tie Spacer

Group 5
- Concrete Mixers (over one (1) cu. yd.)
- Concrete Pumps or Pumpcrete Guns
- Elevator and Material Hoist (one (1) drum)
- Groundman for Asphalt Milling and similar

Group 6
- Auger type drilling equipment up to and including 30 ft. depth digging capacity M.R.C.
- Boom Truck or Dual-Purpose A-Frame Truck
- B.L.H. Lima Road Pactor or similar
- Chip Box Spreader (Flaherty type or similar)
- Concrete Batch Plant (wet or dry)
- Concrete Saws (highways, streets, airports, canals)
- Locomotives (over thirty (30) tons)
- Maginnis International Full Slab Vibrator (airports, highways, canals and warehouses)
- Mechanical Finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types)
- Mechanical Burn, Curb and/or Curb and Gutter Machine (concrete or asphalt)
- Pavement Breaker, Truck Mounted, with compressor combination
- Pavement Breaker or Tamper (with or without compressor combination)
- Power Jumbo Operator (setting slip-forms, etc., in tunnels)
- Roller Operator (except asphalt)
- Self-Propelled Tape Machine

- Self-Propelled Compactor (single engine)
- Self-Propelled Power Sweeper Operator
- Slip-Form Pump (power-driven by hydraulic, electric, air, gas, etc. lifting device for concrete forms)
- Small Rubber-Tired Tractors
- Snooper Crane, Paxton-Mitchell or similar
- Stationary Pipe Wrapping, Cleaning and Bending Machine Operator

Group 7

- Auger type drilling equipment over 30 ft. depth digging capacity M.R.C.
- Compressor (over 2)
- Concrete Conveyor or Concrete Pump, truck or equipment mounted (any assistance required shall be performed by an Assistant to Engineer) Boom length to apply
  Concrete Conveyor, Building Site
- Drilling and Boring Machine, vertical and horizontal (not to apply to waterliners, wagon drills or jack hammers)
- Crusher Plant Engineer
- Generators
- Kolman Loader
- Lubrication and Service Engineer (mobile and grease rack)
- Material Hoist (two (2) or more drums)
- Mine or Shaft Hoist
- Pipe Bending Machines (pipeline only)
- Pipe Cleaning Machines (tractor-propelled and supported)
- Pipe Wrapping Machines (tractor-propelled and supported)
- Portable Crushing and Screening Plants
- Post Driller And/or Driver
- Pumps (over 2)
- Screedman (except asphaltic or concrete paving)
- Self-Propelled Boom-Type Lifting Device (center mount) (on ten (10) ton capacity or less)
- Slusher Operator
- Soil Tester (Certified)
- Soils and Materials Tester
- Surface Heater and Planer Operator
- Trenching Machine (maximum digging capacity three (3) ft. depth) (Any assistance in the operation, if needed, shall be performed by an Assistant to Engineer)
- Truck-Type Loader
- Welding Machines (gasoline or diesel)

Group 8

- Articulated on-Site Dump Trucks
- Asphalt Plant Engineer
- Asphalt Milling Machine
- Cast-In-Place Pipe-Laying Machine
- Combination Slusher and Motor Operator
- Concrete Batch Plant (multiple units)
- Dozer Operator
- Drill Doctor
- Elevating Grader Operator
- Stiff Frame Off Road Haul Trucks
- Grooving and Grinding Machine (highways)
- Ken Seal Operator
- Marination Plant
- Loader (up to and including two and one-half (2 1/2) cu. yds)
- Mechanical Finishers or Spreader Machine (asphalt, Barber-Greene or similar)
- Shuttle Buggy

- Mechanical Trench Shield
- Mixermobile
- Push Cats
- Road Oil Mixing Machine Operator Wood-Mixer (and other similar Pugmill equipment)
- Roller Operator (asphalt)
- Rubber-Tired Earthmoving Equipment (up to and including thirty-five (35) cu. yds. "struck " M.R.C., Euclids, T-Pulls, DW10, 20, 21 and similar)
- Water Pull
- Screedman (Barber-Greene and similar) (asphaltic or concrete paving)
- Self-Propelled Compactors with Dozer; Hyster 450, Cat 825 or similar
- Sheepfoot
- Small Tractor (with boom)
- Soil Stabilizer (P & H or equal)
- Timber Skidder (rubber-tired) or similar equipment
- Track Loader
- Tractor-Drawn Scraper
- Tractor Operator
- Tractor-Mounted Compressor Drill Combination
- Trenching Machine Operator (over three (3) feet depth)
- Tri-Batch Paver
- Tunnel Badger or Tunnel Boring Machine Operator
- Tunnel Mole Boring Machine
- Vermeer T-600b Rock Cutter
- Vacuum Truck(excludes trailer mounted vaccums)

Group 9

- Chicago Boom
- Combination Backhoe and Loader (up to and including 3/8 cu. yd.)
- Combination Mixer and Compressor (gunite)
- Heavy Duty Repairman and/or Welder (Shop)
- Lull Hi-Lift (twenty (20) feet or over)
- Mucking Machine
- Sub-Grader (Gurries or other types)
- Tractor (with Boom) (D6 or larger)
- Track-Laying-Type Earthmoving Machine (single engine with tandem scrapers)

Group 10

- Boom-Type Backfilling Machine
- Bridge Crane
- Cary-Lift or similar
- Chemical Grouting Machine
- Chief of Party
- Derricks (two (2) Group 10 Operators required when swing engine remote from hoist)
- Derrick Barges (except excavation work)
- Euclid Loader and similar types
- Heavy Duty Repairman and/or Welder (Field)
- Heavy Duty Rotary Drill Rigs
- Lift-Slab (Vagtborg and similar types)
- Loader (over two and one-half (2 1/2 cu. yds. up to and including four (4) cu. yds.)
- Locomotive (over one hundred (100) tons, single or multiple units)
- Multiple-Engine Earthmoving Machines (Euclid Dozers, etc.)
- Pre-Stress Wire Wrapping Machine
- Rubber-Tired Scraper, Self-Loading

- Single-Engine Scraper (over thirty-five (35) cu. yds.)
- Shuttle Car (Reclaim Station)
- Train Loading Station
- Trenching Machine multi-engine with sloping attachments (Jefco or similar)
- Vacuum Cooling Plant
- Whirley Crane (up to and including twenty-five (25) tons)

Group 10A

- Backhoe-Hydraulic (up to and including one (1) cu. yd.)
- Backhoe (up to and including one (1) cu. yd.) (Cable)
- CMI Dual Lane Auto-Grader SP30 or similar type
- Cranes (not over twenty-five (25) tons) (hammerhead and gantry)
- Gradalls (up to and including one (1) cu. yd.)
- Motor Patrol Operator
- Power Shovels, Clamshells, Draglines, Cranes (up to and including one (1) cu. yd.)
- Rubber-Tired Scraper, Self-Loading (twin engine)
- Self-Propelled Boom-Type Lifting Device, center mount (over 10 tons up to and including 25 tons)

Group 11

- Automatic Asphalt or Concrete Slip-Form Paver
- Automatic Railroad Car Dumper
- Canal Trimmer
- Cary Lift, Campbell or similar type
- Cranes (over twenty-five (25) tons)
- Euclid Loader when controlled from the Pullcat
- Finish Blade
- Gradesetter, Grade Checker
- Highline Cableway Operator
- Loader (over four (4) cu. yds. up to and including twelve (12) cu. yds.)
- Multi-Engine Earthmoving Equipment (up to and including seventy-five (75) cu. yds. struck m.r.c.)
- Multi-Engine Scrapers (when used to Push Pull)
- Power Shovels, Clamshells, Draglines, Backhoes Gradalls (over one (1) cu. yd. and up to and including seven (7) cu. yds. m.r.c.)
- Self-Propelled Boom-Type Lifting Device (center mount) (over 25 tons m.r.c.)
- Self-Propelled Compactor (with multiple-propulsion power units)
- Single-Engine Rubber-Tired Earthmoving Machine, with Tandem Scraper
- Slip-Form Paver (concrete or asphalt)
- Tandem Cats and Scraper
- Tower Crane Mobile (including Rail Mount)
- Truck Mounted Hydraulic Crane when remote control equipped (over 10 tons up to and including 25 tons)
- Universal Liebher and Tower Cranes (and similar types)
- Wheel Excavator (up to and including seven hundred fifty (750) cu. yds. per hour)
- Whirley Cranes (over twenty-five (25) tons)

Group 11A

- Band Wagons (in conjunction with Wheel Excavators)
- Operator of Helicopter (when used in construction work)
- Loader (over twelve (12) cu. yds.)
- Multi-Engine Earthmoving Equipment (over seventy-five (75) cu. yds. "struck" m.r.c.)
- Power Shovels, Clamshells, Draglines, Backhoes, and Gradalls (over seven 7 cu. yds. m.r.c.)
- Remote-Controlled Earth Moving Equipment
- Wheel Excavator (over seven hundred fifty (750) cu. yds. per hour)

Group 11B

- Holland Loader or similar or Loader (over 18 cu. yds.)

OPERATING ENGINEERS - STEEL FABRICATOR & ERECTOR

Group 1

- Cranes over 100 tons
- Derrick over 100 tons
- Self-Propelled Boom Type Lifting Devices over 100 tons

Group 2

- Cranes over 45 tons up to and including 100 tons
- Derrick, 100 tons and under
- Self-Propelled Boom Type Lifting Device, over 45 tons
- Tower Crane

Group 3

- Cranes, 45 tons and under
- Self-Propelled Boom Type Lifting Device, 45 tons and under

Group 4

- Chicago Boom
- Forklift, 10 tons and over
- 59
- Heavy Duty Repairman/Welder

Group 5

- Boom Cat

OPERATING ENGINEER -PILE DRIVER

Group 1

- Derrick Barge Pedestal mounted over 100 tons
- Clamshells over 7 cu. yds.
- Self-Propelled Boom Type Lifting Device, over 100 tons
- Truck Crane or Crawler, land or barge mounted over 100 tons

Group 2

- Derrick Barge Pedestal mounted 45 tons up to and including 100 tons
- Clamshells up to and including 7 cu. yds.
- Self-Propelled Boom Type Lifting Device over 45 tons
- Truck Crane or Crawler, land or barge mounted, over 45 tons up to and including 100 tons

Group 3

- Derrick Barge Pedestal mounted under 45 tons
- Self-Propelled Boom Type Lifting Device 45 tons and under
- Skid/Scow Piledriver, any tonnage
- Truck Crane or Crawler, land or barge mounted 45 tons and under

Group 4

- Assistant Operator in lieu of Assistant to Engineer
- Forklift, 10 tons and over
- Heavy Duty Repairman/Welder

Group 5

No current classification

Group 6

- Deck Engineer

Group 7

No current classification

Group 8

- Deckhand
- Fireman

SECTION 01200 - PROJECT MEETINGS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for project meetings including, but not limited, to the following:

1. Pre-Construction Conference

2. Pre-Installation Conferences

3. Coordination Meetings

4. Progress Meetings

5. Start-up / Training

6. Service, maintenance, warranty review.

B. Construction Schedules are specified in Division 1 SECTION 01310-A – PROGRESS SCHEDULES.

1.3 PRE-CONSTRUCTION CONFERENCE

A. The Contractor shall schedule a pre-construction conference and organizational meeting at the project site or other convenient location no later than fifteen (15) days after execution of the Contract and prior to commencement of any construction activities. The Contractor shall conduct the meeting to review scope, responsibilities, personnel assignments, Permits, submittals, safety, emergency action plans, contacts, schedule, etc.

B. Attendees: Owner; Architect, and their consultants; Contractor and their Superintendent and major sub-contractors; and manufacturers, suppliers and other concerned appropriate parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:

1. Construction schedule

2. Critical work sequencing

3. Designation of responsible personnel

4. Procedures for processing field decisions and change orders

5. Procedures for processing Applications for Payment

6. Submittal of Shop Drawings, product data and samples

7. Preparation of Record Documents

8. Use of the premises

9. Office, work and storage areas

10. Equipment deliveries and priorities

11. Safety and Security, emergency procedures

12. Housekeeping

13. Working hours

1.4 PRE-INSTALLATION CONFERENCES

A. Conduct a pre-installation conference at the site before each major construction activity that requires coordination with other construction. The installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination of integration with other materials and installations that have preceded or will follow, shall attend the meeting. The Contractor shall advise the Architect of scheduled meeting dates.

B. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:

1. Contract Documents

2. Options

3. Related Change Orders

4. Purchases

5. Deliveries

6. Shop Drawings, products data and quality control samples
7. Possible conflicts
8. Compatibility problems
9. Time schedules
10. Weather limitations
11. Manufacturer's recommendations
12. Compatibility of materials
13. Acceptability of substrates
14. Temporary facilities
15. Space and access limitations
16. Governing regulations
17. Inspection and testing requirements
18. Required performance results
19. Recording requirements
20. Protections

C. Record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the minutes of the meeting to everyone concerned, promptly, including the Owner and the Architect.

D. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS MEETINGS

A. Conduct a weekly progress meeting at the project site at regularly scheduled intervals. Coordinate with the Owner and the Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request, Change Order request, mockup reviews, etc.

B. Attendees: In addition to representatives of the Owner, Architect, Construction Manager each sub-contractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future work shall be represented at these meetings by persons familiar with the project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's construction schedule, whether on time or ahead or behind schedule. Determine how construction that is behind schedule will be expedited; and secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the allotted contract time.

2. Review the present and future needs of each entity present, including such items as:

    a. Interface requirements
    b. Time
    c. Sequence
    d. Deliveries
    e. Off-site fabrication problems
    f. Access
    g. Site utilization
    h. Temporary facilities
    i. Hours of work
    j. Hazards of work
    k. Housekeeping
    l. Quality and work standards
    m. Change Orders
    n. Documentation of information for payment requests

D. Reporting: No later than three (3) days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

1. Schedule Updating: update the construction progress schedule after each progress meeting where modifications to the schedule have been made or recognized. Issue the updated schedule concurrently with the report of each meeting.

1.6 GUARANTEE/WARRANTIES; BONDS; AND SERVICE AND MAINTENANCE CONTRACTS REVIEW MEETING:

A. Eleven (11) months following the date of Substantial Completion of the work, hold a meeting for the purpose of review of guarantees/warranties; bonds; and service and maintenance contracts for materials and equipment.

B. Meeting location shall be at a mutually agreed upon site, as convenient as possible for all parties.

C. Attending shall be representatives of the following:

1. Owner

2. Architect

3. Owner's and Architect's Consultants, as appropriate to the agenda

4. Construction Manager

5. Commissioning Agent

6. Contractor

7 Sub-contractors, as appropriate to the agenda

8. Suppliers, as appropriate to the agenda

9. Others, as appropriate to the agenda

D. Owner will prepare an agenda for the meeting and distribute it to the attendees a minimum of seven (7) calendar days in advance of the scheduled meeting date.

E. The Contractor shall take action as appropriate to implement repair or replacement of defective items and to extend service and maintenance contracts.

F. Owner or Owners Representative shall take meeting notes and distribute them to all attendees. Attendees taking exception to anything in the meeting notes shall state in writing to the Owner within five (5) working days, following receipt of meeting notes.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01200

SECTION 01300 – SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for submittals required for performance of the work, including the following:

1. Submittal Schedule
2. Daily Construction Reports
3. Shop Drawings
4. Product Data
5. Samples
6. Quality Assurance Submittals
7. Record Drawings
8. Record Specifications

B. Administrative Submittals: Refer to other Division 1 Sections and other contract documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits
2. Applications for Payment
3. Performance and Labor & Material Bonds
4. Insurance Certificates
5. List of Sub-Contractors

C. Related Sections: The following sections contain requirements that relate to this section:

1. Division 1 SECTION 01027 – APPLICATION FOR PAYMENT specifies requirements for submittal of the Schedule of Values.

2. Division 1 SECTION 01040 - COORDINATION specifies requirements governing preparation and submittal of required coordination drawings.

3. Division 1 SECTION 01200 – PROJECT MEETING specifies requirements for submittal and distribution of meeting and conference minutes.

4. Division 1 SECTION 01400 – QUALITY CONTROL specifies requirements for submittal of inspection and test reports.

5. Division 1 SECTION 01700 – CONTRACT CLOSEOUT specifies requirements for submittal of project Record Documents and warranties at project closeout.

1.3 DEFINITIONS

A. Coordination drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

1. Preparation of coordination drawings is specified in Division 1 SECTION 01040 - COORDINATION and may include components previously shown in detail on Shop Drawings or Product Data.

B. Field samples are full size physical examples erected onsite to illustrate finishes, coatings or finish materials. Field samples are used to establish the standard by which the work will be judged.

C. Mockups are full size assemblies for review of construction, coordination, testing or operation; they are not samples.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.

a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

   a. Allow three (3) weeks for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals, or needs additional information to complete review.
   b. If an intermediate submittal is necessary, process the same as the initial submittal.
   c. Allow two (2) weeks for reprocessing each submittal.
   d. No extension of contract time, overhead or profit will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the work to permit processing.
   e. Allow four (4) weeks for initial review of any submittal requiring review by Authority Having Jurisdiction (AHJ). A listing of these known submittals is indicated on the contract drawings, but this is not necessarily exhaustive.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4” x 5” (100 x 125 mm) on the label or beside the title block on the Shop Drawings to record the Contractor's review and approval markings and the action taken.

2. Include the following information on the label for processing and recording action taken:

   a. Project Name
   b. Date
   c. Name and Address of the Architect
   d. Name and Address of the Contractor
   e. Name and Address of Sub-Contractor
   f. Name and Address of Supplier
   g. Name of the Manufacturer
   h. Number and Title of appropriate specification section
   i. Drawing Number and detail references, as appropriate

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from contract document requirements, including variations and limitations. Include Contractor's certification that information complies with contract document requirements.

2. Transmittal Form: Use AIA Document G810.

1.5 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within ten (10) days of the date required for submittal of the Contractor's construction schedule.

1. Coordinate submittal schedule with the list of sub-contracts, schedule of values and the list of products as well as the Contractor's construction schedule.

2. Prepare the schedule in chronological order. Provide the following information:

a. Scheduled date for the first submittal
b. Related section number
c. Submittal category (Shop Drawings, Product Data or Samples)
d. Name of the Sub-Contractor
e. Description of the part of the work covered
f. Scheduled date for resubmittal
g. Scheduled date for the Architect's final release or approval

B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, Sub-Contractors and other appropriate parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site and submit duplicate copies to the Architect and Owner daily:

1. List of sub-contractors at the site
2. Exact count of personnel at the site from each contractor or sub-contractor
3. Time spent by each person working on site vs off the job site
4. High and low temperatures, general weather conditions
5. Accidents and unusual events
6. Meetings and significant decisions
7. Stoppages, delays, shortages and losses
8. Emergency procedures
9. Orders and requests of governing authorities
10. Change Orders received, implemented
11. Services connected, disconnected
12. Equipment or system tests and startups
13. Partial Completions, occupancies
14. Substantial Completions authorized
15. Record Drawing identified changes
16. Record Specification identified changes

1.7 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle or otherwise indicate deviations from the contract documents. Do not reproduce contract documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

1. Dimensions

2. Identification of products and materials included by sheet and detail number

3. Compliance with specified standards

4. Notation of coordination requirements

5. Notation of dimensions established by field measurement

6. Sheet Size: Except for templates, patterns and similar full size drawings, submit Shop Drawings on sheets at least 8½" x 11" but, no larger than 30" x 42".

7. Submit in the quantity the Contractor requires to be returned, together with four (4) additional copies each of brochures, catalog cuts and similar material for mechanical, electrical, hardware and elevator items; and three (3) additional copies for all others.

8. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.8 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing in diagrams and templates, standard wiring diagrams and performance curves.

1. Mark each copy to show applicable choices and options. Where printed, Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:

   a. Manufacturer's printed recommendations
   b. Compliance with trade association standards
   c. Compliance with recognized testing agency standards
   d. Application of testing agency labels and seals
   e. Notation of dimensions verified by field measurement
   f. Notation of coordination requirements

2. Do not submit Product Data until compliance with requirements of the contract documents has been confirmed.

3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.

4. Submittals: Submit three (3) copies of each required submittal; submit four (4) copies where required for maintenance manuals. The Architect will retain one and will return one (1) marked with action taken and corrections or modifications required. One (1) copy with review comments will be supplied to the Owner.

    a. Unless non-compliance with contract document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, sub-contractors, suppliers, manufacturers, fabricators and others required for performance of construction activities. Show distribution on transmittal forms.

    a. Do not proceed with installation until a copy of Product Data is in the installer's possession.
    b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.9 SAMPLES

A. Submit full size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets and swatches showing color, texture and pattern.

1. Mount or display samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Architect's sample. Include the following:

    a. Specification section number and reference
    b. Generic description of the sample
    c. Sample source
    d. Product name or name of the manufacturer
    e. Compliance with recognized standards
    f. Availability and delivery time

2. Submit samples for review of size, kind, color, pattern, texture, and lead content testing for all paints and painted materials. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

    a. Where variation in color, pattern, texture or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.

b. Refer to other specification sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
c. Refer to other sections for samples to be returned to the Contractor for incorporation in the work. Such samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of sample submittals.
d. Samples not incorporated into the work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
e. Samples that are tested by WCSD to have any lead content shall be rejected.

3. Preliminary Submittals: Submit a full set of choices where samples are submitted for selection of color, pattern, texture or similar characteristics from a range of standard choices.

   a. The Architect will review and return preliminary submittals with the Architect's notation, indicating selection and other action.

4. Submittals: Except for samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit three (3) sets. The Architect will return one set marked with the action taken.

5. Maintain sets of samples, as returned, at the project site, for quality comparisons throughout the course of construction.

   a. Unless non-compliance with contract document provisions is observed, the submittal may serve as the final submittal.
   b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to sub-contractors, manufacturers, fabricators, suppliers, installers and others as required for performance of the work. Show distribution on transmittal forms.

1. Field samples are full size examples erected on site to illustrate finishes, coatings or finish materials and to establish the project standard.

   a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 QUALITY ASSURANCE SUBMITTALS

A. Submit quality control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports and other quality control submittals as required under other sections of the specifications.

B. Certifications: Where other sections of the specifications require certification that a product, material or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 SECTION 01400 – QUALITY CONTROL.

1.11 ARCHITECT'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When the Architect marks a submittal "No Exceptions Taken," the work covered by the submittal may proceed provided it complies with requirements of the contract documents. Final payment depends on that compliance.

2. Final-But-Restricted Release: When the Architect marks a submittal "Implement Exception Noted," the work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the contract documents. Final payment depends on that compliance.

3. Returned for Resubmittal: When the Architect marks a submittal "Not Approved, Revise and Resubmit," do not proceed with work covered by the submittal, including purchasing, fabrication, delivery or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

a. Do not use, or allow others to use, submittals marked "Not Approved, Revise and Resubmit" at the project site or elsewhere where work is in progress.
b. When the submittal review action stamp is marked “Rejected”, do not proceed with that portion of the work covered by the submittal including, but not limited to, purchasing, fabrication, delivery or other activity. Make a new submittal in accordance with the review notations on the submittal and resubmit without delay in the same manner and number as for the original submittal. Resubmit as often as necessary as required to obtain an unrestricted or restricted release action. “Rejected” review action stamp notation shall not be construed by the Contractor as a valid reason for an increase in contract time.

4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."

C. Unsolicited Submittals: The Architect will return unsolicited submittals to the sender without action.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01300

SECTION 01310B – PROGRESS SCHEDULES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. References

B. Schedule Submittal Requirements

C. Schedule Submittal Format

D. CPM Schedule Structural Requirements

E. Updating Schedules

F. Schedule Revisions

G. Time Extensions

H. Three Week Look Ahead Schedule

1.2 RELATED SECTIONS

A. SECTION 00100 – INSTRUCTIONS TO BIDDERS

B. SECTION 00800 – SUPPLEMENTARY GENERAL CONDITIONS

C. SECTION 01010 – SUMMARY OF WORK

D. SECTION 01027 – APPLICATION FOR PAYMENT

E. SECTION 01300 – SUBMITTALS

1.3 REFERENCES

A. Reference: O'Brien, James J., and Fredric L Plotnick, *"CPM in Construction Management"*, 7th Ed., McGraw-Hill, Inc., New York, 2010.

1.4 SCHEDULE SUBMITTAL REQUIREMENTS

A. Preliminary Documents: Submit, in duplicate, as described in Part 1.5 A., to the Owner and Architect at the Pre-construction Conference the following Preliminary Documents defining planned operations:

1. Preliminary Schedule (90 Day) (bar chart PDF and electronic P6 XER file)

2. Submittal Schedule

B. The Architect and Owner will review schedule submittals; such review shall not constitute an approval or acceptance of the Contractor's construction means, methods, sequencing, or its ability to complete the Work in a timely manner.

C. The Preliminary Documents will illustrate, at a minimum, a detailed baseline schedule for those activities commencing within the first ninety (90) calendar days after the Notice to Proceed is issued by the Owner (Preliminary Schedule (90 Day)). Within seven (7) calendar days after the date of the Pre-construction Conference, the Contractor, including its primary superintendent, will participate in a Schedule Review meeting with the Owner and Architect. As part of the review meeting, the Contractor will be prepared to explain its approach to the scheduling, sequencing of the work, submittals, cash flow forecast, and its approach and inclusion of non-work and weather related days. Based on comments provided by the Owner and Architect, as well as agreed to changes by all parties, the Contractor will revise and resubmit the Preliminary Schedule (90 Day) and progress curve within seven (7) calendar days from the date of the Schedule Review meeting.

D. Baseline Documents: The Contractor shall submit the completed Baseline Schedule to the Owner and Architect within thirty (30) calendar days from the Notice of Award. The schedules shall integrate the activities of the Preliminary Schedule (90 Day), and include all activities required for contract completion.

1. Within fourteen (14) calendar days after receipt of the complete Baseline Schedule, the Owner and Architect will communicate in writing, its comments and concerns to the Contractor. Within five (5) working days, Contractor shall adjust the Baseline Schedule and Progress Curve to incorporate comments from the Owner and Architect and re-submit.

2. Upon Owner and Architect receipt and acknowledgment of revisions to the Baseline Schedule and Progress Curve, the Baseline Documents shall become part of the Contract Documents.

E. The Contractor shall not submit a Baseline Schedule that indicates a contractual substantial completion date earlier than the Contractual Substantial Completion Date as defined in the Washoe County School District's issued Notice to Proceed letter. Any Baseline Schedule submission that indicates an early completion of the project shall be rejected. In any event, if the Contractor should plan to complete the work earlier than the Contractual Substantial Completion Date, the Owner shall not be liable to the Contractor for any costs or other damages if the Contractor is unable to complete the work before the Contractual Substantial Completion date.

F. Should the Contractor fail to define an element of work, activity or logic and the Owner and / or Architect does not detect this omission during the review of the Baseline Schedule, the Contractor shall be required to correct this omission(s) when discovered by the Owner and / or Architect and / or Contractor. The correction(s) will be made before the next Monthly Schedule Update after the

omission(s) is discovered. The inclusions of this correction(s) shall not be cause for delay of the completion of the work within the specified contract time or any increase in cost.

G. Include the submission and approval of the Baseline Schedule as a cost line item in the Schedule of Values. All Payments to the Contractor shall be withheld until such schedule, satisfactory in form and substance to the Owner and Architect, has been received and approved.

H. After the Baseline Schedule has been approved, no change in logic and / or durations shall be made without first providing written notification to Owner and Architect for Contractor's need to change, and approval for these changes has been provided to the Contractor by the Owner and Architect. Consideration will be given for Contractor changes if they are determined to be reasonable by narrative explanation. Acceptance or rejection of any requested revisions is without liability to the Owner, Architect, or any of their representatives. Unreasonable logic or duration changes to simply accommodate a perception of being on schedule will not be accepted.

I. Failure to provide the required schedule information at the required times will result in denial of progress payments, until such time that the schedule information is submitted in the correct format, at the sole discretion of the Owner.

J. Re-Baseline Schedule: At the discretion of the Architect and / or Owner, when the most current Monthly Schedule Update no longer represents the planned sequence of construction as reflected in the approved Baseline Schedule, the Architect and / or Owner may require that a Re-Baseline Schedule be prepared. This Re-Baseline Schedule shall indicate the Contractors revised plan to complete the project within the Contractual Substantial Completion date.

K. Recovery Schedule: When the most current Monthly Schedule Update indicates a delay based on the actual progress of the work of negative fifteen (-15) or less calendar days versus the planned progress in the approved Baseline Schedule, the Architect and / or Owner may require that a Recovery Schedule be prepared. This Recovery Schedule shall indicate the Contractors revised plan and methods that will be used to complete the project by the Contractual Substantial Completion date. The Recovery Schedule will be required within ten (10) calendar days of request by Architect and / or Owner. Failure to provide the required schedule information at the required times will result in denial of progress payments, until such time that the schedule information is submitted in the correct format, at the sole discretion of the Owner.

1.5 SCHEDULE SUBMITTAL FORMAT

A. Follow the guidelines below when submitting a Baseline, Update or Look-ahead Schedule.

B. Required Submittals:

1. Bar Chart: sheet size to be 8-1/2 x 11 inches minimum, organized by the WBS as prescribed herein.

2. The formatting of the hard-copy and electronic submissions of the Baseline Schedule, Schedule Updates and 3-Week Look-ahead Schedules shall include the following information in the order shown:

   a. Activity ID Number
   b. Activity Description
   c. Calendar ID
   d. Original Duration
   e. Remaining Duration
   f. Percent Complete
   g. Total Float
   h. Early Start Date
   i. Early Finish Date
   j. Primary Baseline Early Start (except on Baseline Schedule)
   k. Primary Baseline Early finish (except on Baseline Schedule)

3. On all Update and Look-ahead Schedules, the approved Baseline Schedule shall be included as the Primary Baseline Schedule and be shown as the Primary Baseline Bar with Primary Baseline Early Start and Primary Baseline Early Finish dates. The format of the Title Block shall include (at a minimum) Contractor's name, school name, project number, file name, start date, finish date, data date and run date.

4. Required Electronic Media: Provide all Schedule files in PDF and XER format electronically on CD, DVD, or flash drive and via an attachment to an email to the Owner and Architect. The Contractor is to provide two (2) electronic copies of all Baseline and Schedule Updates including the 3-Week Look-ahead Schedules in the prescribed scheduling software format. Electronic media shall have the Contractor's name, school name, project number, schedule file name, and data date labeled. All Schedule data files must be created by excluding any necessity of user names and/or password requirements. 3-Week Lookahead files for the weeks preceding the month end Schedule Update may be placed on the same media.

5. The Contractor will be responsible for planning, scheduling, managing, and reporting the progress of the Work in accordance with this specification section.

6. All Contract required Construction Schedules shall be prepared by a competent scheduler, and used by the Contractor to plan, prosecute, and

coordinate the Work in an orderly and expeditious manner. The approved Baseline Schedule will be used by the Owner and the Architect to evaluate progress and status of the required Update Schedules at the various stages of the Project and establish the basis for progress payments.

7. Required Critical Path Method (CPM) software, using compatible hardware, to be used for scheduling:

   a. Oracle's Primavera P6, Version 15.1 or the most current version available for purchase.

1.6 CPM SCHEDULE STRUCTURAL REQUIREMENTS

The following requirements have been defined in an effort to create consistency across all project schedules for purpose of analysis.

A. File Naming Schemes For Schedules are to use the following italicized naming schemes with Brookman Elementary School as a sample:

1. Preliminary Schedule:
   Brookman ES – Preliminary v1 <original submission>
   Brookman ES – Preliminary v2 <resubmission>

2. Baseline Schedule:
   Brookman ES – Baseline v1 <original submission>
   Brookman ES – Baseline v2 <resubmission>

3. Monthly Schedule Update:
   Brookman ES – Update #01 2016-07

4. Three-week Look-ahead Schedules provided at the weekly Project Meetings are to be a working schedule, each with a unique file name. The reason for this is to accommodate WCSD program-wide scheduling needs.
   Brookman ES – Weekly #01 2016-07-02 <year, month, day>

B. Structure of Schedule:

1. No work activities in the Schedule shall have an Original Duration greater than fifteen (15) workdays, except for Submittals; Fabrication and Delivery of Materials and Equipment; and Level of Effort tasks, without prior approval of the Owner. For all required Submittal Activities, please refer to Project Manual Section 01300, Shop Drawings, for the allowed submission timeframe after the Pre-Construction conference. All Submittal activities must conform to this timeframe.

2. Dependencies between activities shall be indicated so that it may be established as to the effect the progress of any one activity would have on the Schedule. Dependencies shall make use of Finish-to-Start (FS), Start-to-Start (SS), and Finish-to-Finish (FF) logic relationships. All activities that have a successor Start-to-Start relationship shall also include a successor Finish-to-Start or Finish-to-Finish relationship. There shall not be any open-ended activities except as noted below. Use of Start-to-Finish (SF) logic ties shall not be allowed without written justification and acceptance by the Owner and Architect prior to implementation. Leads or lags will not be used when the creation of an activity will perform the same function (e.g., concrete cure time). Dependencies shall not make use of negative lags. The use of any lead or lag shall require a written explanation by the Contractor in a narrative Report. All activities, except Notice to Proceed and Final Completion, are required to have at least one predecessor and one successor.

3. Date/time constraint(s), other than those required by the contract, will not be allowed unless the Contractor specifically asks in a narrative how they intend to use these constraints and they are accepted by the Owner and Architect. The only exception is that Zero-Free Float constraints may only be used to set individual Pre-Construction Meetings to within 5 days of the first time occurrence of each meeting.

4. Calendars: Define at least two (2) calendars for the schedule.

    a. Calendar 1 shall be a five day week (work days) and is to reflect Saturdays, Sundays, and all Holidays as non-workdays.
    b. Calendar 2 shall be seven day week (calendar days) and is to reflect Saturdays, Sundays, and Holidays as workdays.
    c. When defining calendars, use “Total Work Hours/Day”; do not use “Detailed Work Hours/Day”. The latter occasionally creates issues with start and finish times and dates.
    d. The aforementioned two calendars and any others are to be “Project” calendars. Use of “Global” or “Resource” calendars are prohibited.

5. The schedule should be broken down into logical areas of work and any interim/internal or area substantial completions by use of a Work Breakdown Structure (WBS). In the WBS, minimally separate schedule activities by building or major areas, if within one building. Within each building separate the schedule activities by Building System per ASTM Uniformat II Classification for Building Elements (E1557) Level 2 Group Elements. At a minimum, the following areas shall be included:

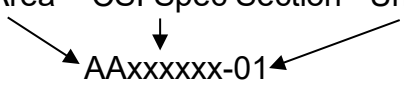
    a. Milestones
    b. Level of Effort Summary
    c. Prepare and Transmit Submittals

d. Review Submittals
e. Material Procurement & Delivery
f. On Site Work
g. Retaining Walls (if applicable)
h. Off Site Work
i. Building Foundation & SOG
j. Building Structure
k. Building Exterior Enclosure
l. Building Roofing
m. Building Interior Framing & Rough-in
n. Building Interior Finishes & Trim
o. Punchlist, Testing & Inspection
p. Commissioning
q. OFCI (Owner Furnished Contractor Installed)
r. District Specific Systems (Audio, Video, CCTV, Clock Speaker, etc.)
s. FFE (Fixtures Furnishings and Equipment)
t. Moving, Move In, and occupancy

6. Activity Coding

a. In addition to use of the Work Breakdown Structure, develop an Activity Code structure, and code all schedule activities to minimally the following activity codes:
    1) Area
    2) Subarea
    3) Responsibility

7. Activity Properties
    a. Schedule activities will have the following properties:
        1) Standard Activity ID naming
            a) The Contractor shall submit a naming scheme for Activity ID numbers that shall be used throughout the project. Activity ID length shall not exceed eleven (11) characters. Once accepted, the naming scheme will be used for the duration of the project, and Activity IDs shall not change.
        2) Activity ID numbers should be formatted so as to provide an indication of where that work is located. We suggest that work in Area A be identified as AAxxxxx-01, etc. The “xxxxxx” following the area ID should be the CSI spec section for the work; and the -01 (-02, etc.) suffix is for multiple activities within the same area and CSI section.



        3) Each activity shall have a narrative description consisting of a

Verb or work function (e.g.; form, pour, excavate), an Object (e.g.; slab, footing, under-floor plumbing) and Area (e.g.: 3rd floor, northeast quadrant, basement). No two activities shall have the exact same description.

4) No activity will represent the work of more than one party / entity.

8. Milestones: All Milestones required by the Contract are to be shown in the schedule, with proper logic ties to the work. All of these Milestones are to be sorted as a separate area in the schedule. The following Milestones shall be included, as a minimum, in the Schedule. Milestone type is listed in parentheses.

a. MS00815-01: Notice to Proceed (start milestone), use Calendar 2 (calendar days). This is to be the first activity in the schedule, and the only activity without a predecessor. The date of Notice to Proceed shall be "Day One" as defined in the WCSD issued Notice to Proceed. A successor to this milestone shall be MS00815-04: Contractual Substantial Completion with a FS (xxx) lag, where (xxx) is defined as the Contract Time per the WCSD issued NTP letter.

b. MS00815-02: Off Site Notice to Proceed (start milestone), use Calendar 2 (calendar days). Predecessor is to be MS00815-01: Notice to Proceed with a FS (xx) relationship where the (xx) is the number of calendar days between Project NTP date and the NTP of the offsite work as specified in the Contract Documents. Successors shall be appropriate off-site work.

c. MS00815-04: Contractual Substantial Completion (finish milestone), use Calendar 2 (calendar days). Use a Late Finish Constraint of (xxx) calendar days after NTP, where (xxx) is defined as the Contract Time per the WCSD issued NTP letter. The predecessor activities are to be the Contractors Punchlist activity for each area of the project with FS (0) relationships. The only successor is to be MS00815-05: Final Punchlist, with an FS 0 relationship.

d. MS00815-05: Final Punchlist (finish milestone), use Calendar 2 (calendar days), duration of 45 days. The only successor is to be MS00815-06: Final Completion, with an FS 0 relationship.

e. MS00815-06: Final Completion (finish milestone), use Calendar 2 (calendar days). This is to be the last activity in schedule, and the only activity without a successor.

f. MS01010-01: Areas Ready to Receive Carpet (start milestone), use Calendar 2 (calendar days). The intent of this Milestone is that essentially all construction activities are completed prior to the carpet installation, in order to avoid damage to the carpet. Contractor is to provide predecessor logic that properly portrays this requirement. This activity shall have as a successor activity MS00815-04:

Contractual Substantial Completion with a SS (xx) lag, where the (xx) represents the amount of time this milestone activity must occur prior-to the Contractual Substantial Completion per the requirements of the Contract Documents.

g. MS01010-02: HVAC System Ready for Testing, Adjusting, and Balancing (start milestone), use Calendar 2 (calendar days). The intent of this Milestone is that the HVAC System must be complete and functioning and ready for the Testing, Adjusting, and Balance Work. Furthermore, the Commissioning process must be complete to the extent it will not interfere with the aforementioned Testing, Adjusting, and Balancing Work requirements inclusive of control point to point verification. Contractor is to provide predecessor logic that properly portrays this requirement. This activity shall have as a successor activity MS00815-04: Contractual Substantial Completion with a SS (xx) lag, where the (xx) represents the amount of time this milestone activity must occur prior-to the Contractual Substantial Completion per the requirements of the Contract Documents.

h. MS01010-03: Telephone Conduits & Pull Boxes Complete (start milestone), use Calendar 2 (calendar days). The intent of this Milestone is that essentially all telephone conduits and pull boxes are installed and ready for Owner cable pulling. Contractor is to provide predecessor logic that properly portrays this requirement. This activity shall have as a successor activity MS00815-04: Contractual Substantial Completion with a SS (xx) lag, where the (xx) represents the amount of time this milestone activity must occur prior-to the Contractual Substantial Completion per the requirements of the Contract Documents.

i. MS01010-04: Telephone/Data/Clock/Intercom/Security/Video/CCTV Systems Complete (start milestone), use Calendar 2 (calendar days). The intent of this Milestone is that essentially all telephone, data, clock, intercom, security, video, and CCTV systems are complete. Contractor is to provide predecessor logic that properly portrays this requirement. This activity shall have as a successor activity MS00815-04: Contractual Substantial Completion with a SS (xx) lag, where the (xx) represents the amount of time this milestone activity must occur prior-to the Contractual Substantial Completion per the requirements of the Contract Documents.

j. MS01010-05: Headend Rooms Ready (start milestone), use Calendar 2 (calendar days). The intent of this Milestone is essentially that the headend rooms and all Owner installed equipment are ready for Owner scope. Contractor is to provide predecessor logic that properly portrays this requirement. This activity shall have as a successor activity MS00815-04: Contractual Substantial Completion with a SS (xx) lag, where the (xx) represents the amount of time this milestone activity must occur prior-to the

Contractual Substantial Completion per the requirements of the Contract Documents.

9. Summary (a.k.a. Level of Effort Activities):

   a. The Contractor shall include special activities that are a summary of a sequence of activities. The start of the activity will be the start date of the first activity in the sequence and the finish date will be the finish date of the last activity in the sequence. Use Calendar 2 (calendar days) for all Level of Effort activities.
   b. Included in the Level of Effort area should be a Level of Effort activity designated as Contract Time. It should have Notice to Proceed as its predecessor, with a SS 0 relationship; and Contractual Substantial Completion as its successor, with an FF 0 relationship. The duration of this activity must not exceed the contract time.
   c. Other Level of Effort are to use predecessor logic of SS 0 with the first activities in the Area or major project category and successor logic of FF 0 with the Contractor's Punch List activity for the Area or major project category. Each Area or major project category must have a Contractor's Punch List activity that is properly tied to all work in the Area so that it is the last activity in the Area. The Activity ID numbers for activities designated at each Area as Contractor's Punch List are to conform to the numbering system used for all other activities in the schedule.
   d. The purpose of these Level of Effort activities is to provide monitoring of the contract time and Area or major project category progress. Level of Effort activities are to include at a minimum the following:

(Elementary School)

1) AH00815-01: Contract Time
2) AH00815-02: Building/Area A Duration
3) AH00815-03: Building/Area B Duration
4) AH00815-04: Building/Area C Duration
5) AH00815-05: Building/Area D Duration
6) AH00815-06: Building/Area E Duration
7) AH00815-07: Building/Area F Duration
8) AH00815-07: Building/Area G Duration
9) AH00815-08: On Site Duration
10) AH00815-09: Off Site Duration

(Middle School)

1) AH00815-01: Contract Time
2) AH00815-02: Building A Duration
3) AH00815-03: Building B Duration
4) AH00815-04: Building C Duration

5) AH00815-05: Building D Duration
6) AH00815-06: Building E Duration
7) AH00815-07: Building F Duration
8) AH00815-08: Building G Duration
9) AH00815-09: Central Plant Duration
10) AH00815-10: On Site Duration
11) AH00815-11: Off Site Duration

(High School)

1) AH00815-01: Contract Time
2) AH00815-02: Building 100 Duration
3) AH00815-03: Building 200 Duration
4) AH00815-04: Building 300 Duration
5) AH00815-05: Building 400 Duration
6) AH00815-06: Building 500 Duration
7) AH00815-07: Building 600 Duration
8) AH00815-08: Building 700 Duration
9) AH00815-09: Building 800 Duration
10) AH00815-10: Building 900 Duration
11) AH00815-11: Central Plant Duration
12) AH00815-12: On Site Duration
13) AH00815-13: Off Site Duration

10. Tasks related to the submittal and procurement of material and equipment shall be included as separate activities in the project schedule. Sequences for major material items, such as reinforcing steel, structural steel, and steel joists, etc. shall be shown as individual activities within the schedule. Major equipment items, such as HVAC equipment, electrical equipment, specialty items, and any long lead material or equipment items shall be shown as individual activities within the schedule. Examples of submittal/procurement activities include, but are not limited to:

    a. Material/Equipment submittal preparation
    b. Submittal and Approval of material/equipment
    c. Material/equipment order
    d. Fabrication and/or Delivery of Equipment and Specialty Materials:
        1) Separate Activities shall be required when durations will be greater or equal to 30 calendar days maximum for each delivery.
        2) Delivery Activities that are phased or partial deliveries shall require an Activity ID with logic relationship to installation and/or the related construction activities.
    e. Delivery of extra parts/extra stock/special tools
    f. Notification of Owner furnished materials / equipment delivery requirements

g. Delivery of O&M manuals

11. The approved Baseline schedule shall become the basis for all Weekly Look-ahead and Monthly Schedule Updates. The approved Baseline Schedule shall also be shown as the Primary Baseline Schedule in all Weekly Look-ahead and Monthly Schedule Updates.

12. Construction activities shall include at a minimum, but are not limited to:

    a. Permit Requirements
    b. Tasks corresponding to each specification section covered in the Specification Index in all individual Divisions
    c. Tasks related to mobilization / demobilization
    d. The installation of temporary or permanent work by tradesman
    e. Testing and inspections of installed work by technicians, inspectors, or engineers
    f. Required outside Agency inspections
    g. System utility outages and tie-ins
    h. Start-up and testing of equipment, commissioning of building and related systems
    i. Scheduling of specified manufacturer's representatives
    j. Contractor's Punch list activity by area
    k. Final clean-up
    l. Training to be provided
    m. Final Punch list
    n. Maintenance period
    o. Administrative tasks necessary to start, proceed with, accomplish, or finalize the contract
    p. Monthly weather / non workday considerations

13. The following logic relationships will be required in any precedence diagram method used:

    a. All logical relationships shall be finish to start (FS) as much as practical. Start to start (SS) and finish to finish (FF) relationships may be used as follows:
        1) successors may be SS with a corresponding FF relationship
        2) at a milestone or at the conclusion of the network
        3) use in Level of Effort activities
    b. Lag factor use should be limited. Lag factors shall not be used when the work could be identified as a functional activity (i.e., concrete curing).
    c. Accepted Schedules shall only contain Contract Required Early Start and/or Early Finish Constraints. Additional constraints may be used if authorization from the Owner and / or Architect is received prior to their implementation.

d. The retained logic mode is required for schedule calculations.
e. Under Enterprise / Projects / Settings, “Define Critical Activities” shall be set to “Longest Path” (as opposed to “Total Float less than or equal to”).
f. Any deviations / change from these logic specifications require written request to be reviewed for acceptance from the Architect and Owner prior-to implementation.

1.7 UPDATING SCHEDULES

A. Monthly Schedule Updates shall accompany the monthly Application for Payment, reflecting progress since the previous month’s submittal.

1. Two (2) 8 ½ x 11 inch copies of the Bar Chart, along with two (2) electronic copies containing PDF and XER files, in the scheduling software format, containing the Monthly Schedule Update in addition to the Updated Cash Flow Progress Curve. The Bar Chart will be sorted as noted in Section 01310B-1.5. Email the PDF and XER file to the Owner.

B. The Schedule Update shall show the actual status of all activities. All activities that have a percentage less than 100% shall have a remaining duration in whole one (1) day increments. In addition Activities having a remaining duration of zero cannot be claimed as less than 100% complete. Refer to Part 1.8 for revisions to the Schedule.

C. Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the CPM scheduling software system. Actual Start and Actual Finish dates on the CPM schedule shall match the dates of actual work accomplished in the field and not on projected completion dates.

D. With each monthly update schedule submission, the Contractor shall submit a narrative report including descriptions of any problem areas, current or anticipated delays and their estimated schedule impacts, and the Contractor’s plan to mitigate any of these noted delays. The Contractor shall provide explanation for any delay(s) shown in the schedule updates. If the Contractor should require the addition or deletion of any activity, require a revision(s) to the approved schedule logic, or any other change to the approved schedule, the Contractor shall include a narrative explaining why these revisions are necessary and the anticipated impact to the schedule and Contractual Substantial Completion Date.

E. The Contractor shall provide a computer generated Log Report in digital format using Claim Digger, Schedule Analyzer Pro, or other recognized schedule comparison software, listing ALL changes made between the previously reviewed monthly schedule update and the current monthly schedule update. Identify the name of the Baseline Schedule, previous schedule and name of the current schedule being compared.

1.8 SCHEDULE REVISIONS

A. Updating the schedule to reflect actual progress made up to the data date of a schedule update shall not be considered revisions to the Baseline Schedule.

B. During the progression of the project, if it appears the Monthly Update Schedule no longer represents the actual prosecution of the work as reflected in the Baseline Schedule, the Architect or Owner may request a Revised Baseline Schedule from the Contractor. The revision shall address the Contractor's current construction plan for completing the work without impacting contract time and cost. Approved revisions to the Monthly Schedule Update shall then be incorporated into the previously approved Baseline Schedule. The Revised Baseline Schedule shall then be used as the Primary Baseline Schedule for all subsequent monthly schedule update submissions.

C. The Contractor may also request revisions to the construction schedule logic and activities in the event the Contractor's planning for the work is revised. If the Contractor desires to make changes in the construction schedule to reflect revisions in its method of operating and scheduling of the work, the Contractor shall provide the Architect and Owner the reason(s) for the proposed revisions. The request shall address the Contractor's current construction plan for completing the work without impacting contract time and cost. Accepted revisions to the schedule shall be incorporated into a Revised Baseline Schedule and the current construction schedule at the next Monthly Schedule Update submission.

D. If the Architect or Owner recognizes at any time that the work has fallen sufficiently behind the scheduled Contractual Contract Completion Date, milestones, or phase dates, the Architect or Owner shall require the Contractor to submit a Recovery Schedule. The Contractor shall submit the Recovery Schedule within seven (7) calendar days of the Architect's/Owner's written request. The Contractor will include a narrative with the Recovery Schedule that will describe the Contractors work plan, including all additional resources, materials, equipment, labor, and modifications of operations which will be provided so as to meet the Contractual Substantial Completion Date. The Contractor will provide all such additional resources and modifications of operations without additional cost to the Owner, Any additional costs incurred by the Owner for any Owner provided services such as; inspections, consulting, design and engineering, etc. will be the responsibility of the contractor. Such additional resources and modifications may include but not be limited to:

1. Required overtime for the Contractor's personnel.

2. Increased construction manpower in such quantities as will substantially eliminate the backlog of work and put the project back on schedule.

3. Increase numbers of shifts per working day, working days per week, or the amount of construction equipment, or any combination of the foregoing which will put the project back on schedule.

4. Reschedule activities to achieve the maximum practical concurrence of accomplishment of activities to put the project back on schedule.

5. Supplemental progress schedules detailing the specific operation changes instituted to regain the Contract Schedule.

The Contractor will implement the Recovery Schedule without additional cost to the Owner and provide for completion of the work in accordance with the remaining milestone dates without a time extension. Should the logic and/or durations of the Recovery Schedule not receive acceptance of the Architect and Owner, the Contractor is responsible to use concurrent operations, additional manpower, additional shifts, overtime, etc., including 24-hour production work day, seven (7) day work week operation, as required to put the Project back on schedule at no additional cost to the Owner.

E. Use of float suppression techniques, such as:

1. Preferential sequencing (arranging critical path through activities Owner and/or Architect related activities)using:

    a. Special lead/lag logic restraints,
    b. Zero total or free float constraints except where otherwise noted,
    c. Imposing constraint dates other than as required by the contract,

shall be cause for rejection of the project schedule or its updates. The use of resource Leveling (or similar software features) used for the purpose of artificially adjusting activity durations to consume float and influence the critical path is expressly prohibited.

F. Definitions of Float or Slack

1. Free Float is the length of time the start of an activity can be delayed without delaying the start of a successor activity.

2. Total Float is the length of time along a given network path that the actual start and finish of activity(s) can be delayed without delaying the project completion date.

3. Positive Total Float is for the benefit of the Project and for the mutual use of the Owner and the Contractor.

G. Negative float will not be a basis for requesting time extensions. Any extension of time will be addressed in accordance with Section 01310B “Time Extensions”.

1.9 TIME EXTENSIONS

A. Extensions of time to the Contract may be granted only for delays to activities on the critical path that actually delay the Project completion beyond the Contractual Substantial Completion date or for delays to activities that transform that activity onto the critical path, and, as a result, delay completion beyond Contractual Substantial Completion date.

B. For any period in which a delay to the contract specified Milestones and/or Contractual Substantial Completion is anticipated by the Contractor, a Time Impact Analysis (TIA) shall be submitted in accordance with Contract Documents to the Architect and Owner. Each TIA shall include a detailed Network Diagram demonstrating where the Contractor proposes to incorporate the delay in the most current approved Monthly Update Schedule. The TIA shall show all the current activities affected by the delay and the proposed activity logic relationships caused by the delay. The TIA network diagram shall have a minimum of one (1) current accepted Monthly Update Schedule predecessor and successor. The TIA shall demonstrate the time impact based on the date the delay is noticed by the Contractor or the date the delay began; the Project Status of all construction at that specific point in time; and the event time computation of all affected activities. The event times used in the TIA shall be substantiated by actual dates of occurrence. Included in the Contractor’s TIA shall be a detailed narrative report providing the rationale or basis of entitlement used in developing the TIA request. The preparation of the TIA is considered part of the construction process and will be performed at no additional cost to the Owner.

C. Time Impact Analysis shall be used by the Owner in determining if a time extension or reduction to the contract milestone date(s) is justified. The Contractor may provide a TIA to the Owner for any contract change or as support for a Value Engineering Proposal.

1. The Contractor shall submit a TIA illustrating the influence of a change or delay to the Contractual Substantial Completion Date or milestones. All TIA’s submitted shall utilize the most recently approved Monthly Schedule Update logic to demonstrate the impact(s) or delay(s) alleged to have affected the Contractual Substantial Completion date.

2. Each TIA shall include a Fragmentary Network (Fragnet) demonstrating how the Contractor proposes to incorporate the impact into the Project Schedule. A Fragnet is defined as the sequence of new activities and/or activity revisions, logic relationships and resource changes that are proposed to be added to the most recently approved Monthly Construction Schedule Update at the time of the alleged impact to demonstrate the influence of impacts to the accepted schedule logic. The Fragnet shall

identify the predecessors to the new activities and demonstrate the impacts to successor activities. Include a narrative report describing the effects of new activities and relationships to interim and contract completion dates. The TIA shall include an electronic copy (both PDF and XER) of the TIA Network Diagram and Fragnet.

3. If the TIA was submitted as support for a change order request, following the Contractor's receipt of an executed Change Order, the activity data and logic relationships in the TIA shall be incorporated into the most current Monthly Schedule Update.

D. Each Time Impact Analysis shall demonstrate the estimated time impact based on the events of delay, the date the Change Order was given to the Contractor, the Actual Project status of construction at that point in time.

E. Following the receipt of an executed Change Order, the activity data and logic relationships in the TIA shall also be incorporated into the current accepted Monthly Update Schedule. All TIA Activities shall be coded in a manner that they can be identified to the specific Change Order and TIA.

F. Seasonal weather conditions and resulting impacts shall be included in the planning and scheduling of all work influenced by wind, cold or warm weather, smoke, snow, and/or precipitation to ensure completion of all work within the Contract time.

If all the work, or the portion(s) of the work which are the currently controlling operation(s), are suspended for weather including resulting impacts of weather, so as not to prosecute the work, a time extension at the Owners discretion, **may be awarded if the following conditions are satisfied**

a. The weather shall actually be the delay to the Substantial Completion Date of the project and the delay must be beyond the control and without the fault or negligence of Contractor; weather will be evaluated based on the original baseline schedule without revision if revision is the result of contractor performance; **and**
b. The weather recorded by NOAA / NWS (WS Form: F6) website: (www.weather.gov/climate/index), Reno location or Owner approved location of work during the Contract period shall be found to occur more frequently than the weather normally recorded by NOAA / NWS to be anticipated is documented more frequently occurring than 5 Year NOAA / NWS (WS Form: F6) Averages for all project locations; or
c. Owner/Architect orders the stoppage or suspension of the work in the interest of public safety or health or due to specification requirements.

Weather is defined for the purposes of this Contract to be compared to current recorded National Oceanic and Atmospheric Administration (NOAA) / National Weather Service Preliminary Local Climatological Data (WS FORM: F-6) for Station: Reno, Nevada, or for Owner approved alternate project location, as follows:

- **PRECIPITATION** water equivalent of greater than or equal to 0.1 inch recorded for the 24-hour period, of the date, and /or
- **AVERAGE** wind speed of greater than or equal to 20 miles per hour recorded for the 24-hour period for the date of occurrence. **NOT** 2 Minute Sustained or Gusts as recorded in (WS FORM:F6).

The schedule of anticipated weather delays is based on current National Oceanic and Atmospheric Administration (NOAA) / National Weather Service (NWS) records kept as Preliminary Local Climatological Data (WS FORM: F-6) for Station: Reno, Nevada, (e.g. 5 Year NOAA / NWS (WS Form: F6) Averages) for all project locations **and will constitute the baseline for the total Contract Time weather delay evaluations.** Contractor's CPM schedule shall be understood to include as a minimum, the amount of weather delay days lost in all Contractors' weather dependent activities occurring during the activity.

Contractor, or their authorized representative, shall provide specific written notification with documented backup to both, Owner's designated Project Manager, Owners Consultants, and Architect designated Project Manager, on Company letterhead of the occurrence of qualifying weather and the resultant full day(s) impact to normally scheduled work days, within five (5) calendar days of each occurrence of qualifying weather, whereby preventing work on current critical activities for fifty (50) percent or more of Contractor's normal scheduled work day hours. The Contractor written notice will provide contemporaneously documented information concerning date, work Activities scheduled to be worked, the hours worked for all employees and subcontractors, and time qualifying weather conditions occurred. A Time Extension may be granted when the number of actual weather days calculated from the Notice To Proceed date to the date Contractor asserts the request exceeds the total cumulative non-work weather days using the baseline schedule for the same calendar time period. If Contractor wishes to assert additional claim(s) for time adjustment at a later date(s), each succeeding claim must address the time period from NTP date to the date of the request. No compensation will be made for monetary damages including, but not limited to extended General Conditions, due to weather delay(s). All weather days shall be utilized as a bank of days for entire contract duration and will expire at substantial completion minus unused weather days. Substantial completion will be modified via deductive change order for all unused weather days.

The clear intent of this Contract Weather provision is to establish that the Contractor & Owner/Architect agree that a predetermined weather lost time has been accounted for in the Bid and accepted Baseline Schedule. Each Project has

been determined to have a specific number of Contract Weather Days. Contractors are to make their own determination at time of bid and scheduling weather sensitive work activities as to incidental time for but not limited to (e.g. wet conditions, muddy site, etc.) time lost due to an accepted qualifying weather event as described above. The Contractor is responsible to provide a weatherized Project site at no additional cost or time to the Owner, including but not limited to, work and/or materials protected, temporary site drainage, and SWPP / Dust Control.

The Project's total Weather Days accounted for in Contractor's schedule is to be calculated using the schedule CONTRACT INCLUDED MONTHLY TOTALS OF NON-WORK DAYS. The mathematical calculation will take the actual NTP date of this Contract and prorate the remaining days of the beginning month as a percentage of the month. This percentage is then multiplied by the Non-Work Weather days from the Monthly Total - Non Work schedule, to arrive at a rounded whole number for that month, should the NTP not be on the 1st day of the month. The same pro-rata will be done for the Substantial Completion date of the Contract. All months in between use the Totals given in the Non-Work Weather Days schedule for the same calendar period of this Contract. A grand total of impact days lost would be the cumulative sum of each month starting with the NTP Date and running through the Project Substantial Completion Date.

This total number of impact / lost days will be agreed by all parties to be the "CONTRACT INCLUDED MONTHLY TOTALS OF NON-WORK DAYS", which has already been included and accounted for in this Contract. It is this specific number, that the Contractor and Owner / Architect will use as baseline weather day work impacts for the Project calendar period of time. Any Contractor claims for lost days of work due to weather events as defined herein shall be totaled for the entire project and subtracted from the "CONTRACT INCLUDED MONTHLY TOTALS OF NON-WORK DAYS." It is understood that the impact day(s) claimed by the Contractor must meet the requirements set forth in Section 1.9.G above. Until the Contract Weather Impact Days that have met the specification requirements have been used by deducting each qualifying event from the overall Project Total Days, the Owner / Architect will not consider time extensions for weather impacts. This Contract is a calendar day contract with a specific Notice to Proceed date and a Project Substantial Completion date. The Contractor will choose to use whatever schedule work calendar they want as far as work days per calendar week (e.g. 5 day work week, 6 day work week) when a Baseline Schedule is submitted for acceptance. Should the Contractor choose to utilize a work calendar other than a 5 day per week work schedule, per the CONTRACT INCLUDED MONTHLY TOTALS OF NON-WORK DAYS will have to be re-calculated to match the actual working conditions planned. Any planned schedule requiring a re-calculation of the CONTRACT INCLUDED MONTHLY TOTALS OF NON-WORK DAYS, require Owner acceptance.

Only after the cumulative total "CONTRACT INCLUDED MONTHLY TOTALS OF

NON-WORK DAYS" are exceeded by qualifying days previously accepted, the Owner / Architect may grant time extensions to the Contract Substantial Completion Date for additional qualifying Weather Impact Days accepted. CONTRACT INCLUDED MONTHLY TOTALS OF NON-WORK DAYS will be contemporaneously kept by Owner/Architect during the project duration as they are provided by Contractor for acceptance. Project Impact Days accepted to date, will be memorialized in regularly scheduled project meetings by the Owner PM / Architect PM. Contract Time Extensions granted by Owner will be in accordance with Section 01310, Article 1.9 of Project Manual. CPM Schedule changes can only be made with Owner approval.

The Contractor shall provide monthly activity in the schedule reflecting the "CONTRACT INCLUDED MONTHLY TOTALS OF NON-WORK DAYS" that is included as a result of a calculation from the above schedule for the overall Contract Time from the date of NTP to the date of Substantial Completion. This activity shall have a description of "CONTRACTOR'S NON-WORK DAYS BANK OF TIME." This activity shall be logically tied to the Contractual Substantial Completion as described in Section 1.6 Article B (a through e) along with Section 1.6 Article B (i) – (xiii) and shall be a BANK of time that the Contractor shall draw from as "CONTRACT INCLUDED MONTHLY TOTALS OF NON-WORK DAYS" are approved by Owner / Architect. Any remaining Non-Work weather day that was not utilized shall be reflected in a monthly schedule revision per section 1.8 above and included in subsequent months "Non Work Days Bank of Time" When a NON-WORK Weather Event as defined above is accepted, the Contractor shall at the discretion of the Owner PM / Architect PM, submit a Time Impact Analysis as follows and reduce the allowance with the corresponding amount of NON-WORK delay time granted. Upon acceptance of a Non-Work Weather Day by Owner PM / Architect PM, the Contractor shall utilize the P3 function of "suspend and resume" within the dates function on the Critical Activity determined to be affected and if the accepted weather occurrences happen more than once on a Critical Activity, the Contractor will have to add an Activity as "Non-Work Weather Delay" with each predecessor(s) and successors being the "Critical Activity" so that the Critical Path runs through the Actualized Non-Weather time period and back onto the Critical Path of the Work Activity.

1.10 THREE WEEK LOOK-AHEAD SCHEDULE

A. The Contractor shall provide a P6 three-week look ahead and one-week look behind detailed short-interval schedule for each building or area of the Work, at regularly scheduled progress meetings. The one-week look behind shall reflect actual work performed the previous week. Any other format lookahead schedule must be approved by Owner and Architect and shall match/tie all activities including revisions to the P6 approved lookahead schedule. The format shall be satisfactory to the Owner and Architect. All schedules shall be based upon the most current Architect / Owner accepted Monthly Schedule Update and will indicate the actual progress achieved the previous week as well as the detailed

activities scheduled for the next three weeks and will show anticipated durations, start and completion dates for activities.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01310B

SECTION 01400 – QUALITY CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all contract documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for quality control services.

B. Quality control services include inspections, tests and related actions, including reports performed by the Contractor, by independent agencies and by governing authorities. They do not include contract enforcement activities performed by the Architect.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with contract document requirements.

D. Requirements of this section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality control requirements for individual construction activities are specified in the sections that specify those activities. Requirements in those sections may also cover production of standard products.

2. Specified inspections, tests and related actions do not limit the Contractor's quality control procedures that facilitate compliance with contract document requirements.

3. Requirements for the Contractor to provide quality control services required by the Architect, Owner or Authorities Having Jurisdiction (AHJ) are not limited by provisions of this section.

E. Related Sections: The following sections contain requirements that relate to this section:

1. Division 1 SECTION 01045 – CUTTING AND PATCHING specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.

2. Division 1 SECTION 01300 – SUBMITTALS specifies requirements for development of a schedule of required tests and inspections.

1.3 RESPONSIBILITIES

A. Owners Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, the Owner or Owners representatives/agents, project managers, QA/QC inspectors, coordinators etc. shall provide inspections, tests and other quality control services specified elsewhere in the contract documents and required by AHJ.

1. Where individual sections specifically indicate that certain inspections, tests and other quality control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality control services. Costs for these services are included in the contract sum.

2. Where individual sections specifically indicate that certain inspections, tests and other quality control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.

    a. Where the Owner has engaged a testing agency for testing and inspecting part of the work and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless agreed to in writing by the Owner.

B. Retesting: The Contractor is responsible for retesting where results of inspections, tests or other quality control services prove unsatisfactory and indicate non-compliance with contract document requirements, regardless of whether the original test was the Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated non-compliance with contract document requirements.

C. Associated Services: Cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the work.

2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.

3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.

4. Provide facilities for storage and curing of test samples.

5. Deliver samples to testing laboratories.

6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

7. Provide security and protection of samples and test equipment at the project site.

D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling and testing of materials and construction specified in individual sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.

2. The agency is not authorized to release, revoke, alter or enlarge requirements of the contract documents or approve or accept any portion of the work.

3. The agency shall not perform any duties of the Contractor.

E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities. The Contractor will also be responsible for standby charges from the Owner’s laboratory if they are due to a scheduling error by the Contractor.

1.4 SUBMITTALS

A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test or similar service to the Architect. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test or similar service through the Contractor.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:

    a. Date of issue
    b. Project title and number
    c. Name, address and telephone number of testing agency
    d. Dates and locations of samples and tests or inspections
    e. Names of individuals making the inspection or test
    f. Designation of the work and test method
    g. Identification of product and specification section
    h. Complete inspection or test data
    i. Test results and an interpretation of test results
    j. Ambient conditions at the time of sample taking and testing
    k. Comments or professional opinion on whether inspected or tested work complies with the contract document requirements
    l. Name and signature of laboratory inspector
    m. Recommendations on retesting

1.5 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' *Recommended Requirements for Independent Laboratory Qualification* and that specialize in the types of inspections and tests to be performed.

    1. Each independent inspection and testing agency engaged on the project shall be authorized by AHJ to operate in the State of Nevada.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with the contract document requirements for Division 1 SECTION 01045 – CUTTING AND PATCHING

B. Protect construction exposed by or for quality control service activities and protect repaired construction.

C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

SECTION 01420 – REFERENCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes abbreviations and acronyms, additional definitions, and reference standards used in the contract documents.

B. Refer to Drawings and general provisions of the Contract, including all contract documents and addendums associated with this project for further information.

1.2 ABBREVIATIONS AND ACRONYMS

A. The following abbreviations and acronyms may be used in the contract documents. Refer uncertainties to the Architect for a decision before proceeding.

AA	Aluminium Association
AAADM	American Association of Automatic Door Manufacturers
AAMA	Architectural Aluminum Manufacturers' Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
AFPA	American Forest and Paper Association
AIA	American Institute of Architects
AIMA	Acoustical and Insulation Materials Association
AISC	American Institute of Steel Construction
AMCA	American Movement and Control Association
ANSI	American National Standards Institute
APA	The Engineered Wood Association (formerly the American Plywood Association)
ARI	Air Conditioning and Refrigeration Institute
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers' Association
AWWA	American Water Works Association
AWS	American Welding Society
BHMA	Builders Hardware Manufacturers' Association
BIA	Brick Institute of America
CAL/OSHA	State of California Construction Safety Orders
CALTRANS	State of California, Business and Transportation Agency,

	Department of Transportation, *Standard Specifications*
CCR	California Code of Regulations
CDA	Copper Development Association
CISCA	Ceilings and Interior Systems Construction Association
CFFA	Chemical Fabrics and Film Association, Inc.
CFMG	Cabinet and Fixture Manufacturers Guild
CLFMI	Chain Link Fence Manufacturers' Institute
CPA	Composite Panel Association (formerly the National Particleboard Association)
CRI	Carpet and Rug Institute
CRSI	Concrete Reinforcing Steel Institute
CPSC	United States Consumer Products Safety Commission
CS	Commercial Standard, United States Department of Commerce
CSA	Canadian Standards Association
DASMA	Door and Access Systems Manufacturers Association International
EIMA	EIFS Industry Members Association
EPA	Environmental Protection Agency
ESO	Electrical Safety Orders
FAA	Federal Aviation Administration, United States Department of Transportation
FCC	Federal Communications Commission
FGMA	Flat Glass Marketing Association (now the GANA)
FM	Factory Mutual System, Factory Mutual Engineering Corporation
FS	Federal Specification Unit
GA	Gypsum Association
GANA	Glass Association of North America (formerly the Flat Glass Marketing Association and Glass Tempering Association)
GRI	Geosynthetic Research Institute
GTA	Glass Tempering Association (now the GANA)
HMA	Hardwood Manufacturers Association
HPMA	Hardwood Plywood Manufacturers Association
HPVA	Hardwood Plywood and Veneer Association
HUD	United States Department of Housing and Urban Development
IEEE	Institute of Electrical and Electronic Engineers
IGCC	Insulating Glass Certification Council
ITS-WH	Intertek Testing Service - Warnock Hersey
LSGA`	Laminator’s Safety Glass Association
MIA	Marble Institute of America or the Masonry Institute of America

MIL	Military Standardization Document, United States Department of Defense
MIW	Masonry Institute of Washington
ML/SFA	Metal Lath/Steel Framing Association
MM	“Materials Manual”, State of California, Business and Transportation Agency, Department of Transportation
NAAMM	National Association of Architectural Metal Manufacturers
NBGQA	National Building Granite Quarries Association, Inc.
NBS	National Bureau of Standards (now the NIST)
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NEMA	National Electric Manufacturers' Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association (now the AFPA)
NFRC	National Fenestration Rating Council
NHLA	National Hardwood Lumber Association
NIST	National Institute of Standards and Technology, United States Department of Commerce (formerly the National Bureau of Standards)
NOFMA	National Oak Flooring Manufacturers Association
NPDES	National Pollutant Discharge Elimination System
NRCA	National Roofing Contractors Association
NSF	NSF International (formerly National Sanitary Foundation)
NTMA	National Terrazzo and Mosaic Association
NWWDA	National Wood Window and Door Association (now WDMA)
OSA	Office of the State Architect, State of California
OSHPD	Office of Statewide Health Planning and Development, State of California
PCI	Precast / Prestressed Concrete Institute
PS	Product Standard, United States Department of Commerce
RCW	Revised Code of Washington, State of Washington
RIS	Redwood Inspection Service
SDI	Steel Deck Institute or the Steel Door Institute
SFM	Office of State Fire Marshal, State of California
SIGMA	Sealed Insulated Glass Manufacturer’s Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Society for Protective Coatings (formerly the Steel Structures Painting Council)
SWI	Steel Window Institute
TCA	Tile Council of America

UBC	Uniform Building Code
UFC	Uniform Fire Code
UL	Underwriters Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
USPS	United States Postal Service
USS	United States Standard
WAC	Washington Administrative Code, State of Washington
WCLIB	West Coast Lumber Inspection Bureau
WDMA	Window and Door Manufacturers Association (formerly the National Wood Window and Door Association)
WIC	Woodwork Institute of California
WLPDIA	Western Lath Plaster /Drywall Industries Association (now the WWCCA)
WSDOT	Washington State Department of Transportation
WWCCA	Western Wall & Ceiling Contractors Association
WWPA	Woven Wire Products Association or Western Wood Products Association

B. Additional abbreviations, used only on the drawings, are listed and defined thereon.

USE SECTION 1.03 ONLY IF THESE DEFINITIONS ARE NOT INCLUDED IN THE GENERAL CONDITIONS FOR THE SPECIFIC CONTRACT.

1.03 ADDITIONAL DEFINITIONS

A. In addition to the terms defined in the General Conditions, the following terms are used in the contract documents and are defined as follows:

Accepted Equal	As accepted by the Architect as being of equivalent quality, utility and appearance.
Addenda	Written or graphic instruments issued by the Owner/Architect prior to the execution of the Contract which modify or interpret the bidding documents by additions, deletions, clarifications or corrections.
By Owner	Work on this project that will be performed by the Owner or its agents, at the Owner's cost.
By Others	Work on this project that is outside the Scope of Work to be performed by the Contractor under this Contract, but that will be performed by the Owner, other contractors or other means.
Consultant	A consultant to the Architect
Directed	Directed by the Architect

Furnish	Supply only; do not install
Indicated	As shown and/or noted on the drawings
Install	Install or apply only; do not furnish
Owner-Furnished, Contractor-Installed	The Owner will furnish at their cost and the Contractor shall install under their contract for this work.
Project Manual	The Project Manual consists of two volumes: Volume 1 includes the bidding and contract requirements and Specifications; and Volume 2 includes the details and schedules. One volume which includes the bidding and contract requirements and specifications and the details and schedules.
Provide	Furnish and install
Site	Geographical location of the project
Specified	As written in the specifications

1.4 REFERENCE STANDARDS

A. Specified standards of the construction industry shall have the same force and effect on the performance of the work as if bound or copied directly into the contract documents. Such standards are made a part of the contract documents by reference.

B. Each entity or person engaged in the work shall be familiar with the industry standards applicable to its construction activity.

C. Where compliance with two (2) or more standards is specified and the standards establish different or conflicting requirements for minimum qualities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the Architect for a decision before proceeding.

D. Copies of applicable standards are not bound with the contract documents. Where copies are required for proper performance of the work, obtain and pay for authorized copies directly from publication source and maintain at the site during submittals, planning and performance of work until final acceptance by the Owner. Make such copies of standards available to the Owner and Architect for review upon request.

E. For products or quality of installation specified by association, trade, military, federal or other reference standards, comply with requirements of the standard, except when more rigid requirements are specified in the contract documents or are required by applicable codes and/or public Authorities Having Jurisdiction (AHJ).

1. Except as otherwise indicated or specified, where compliance with a reference standard is required, comply with the standard in effect as of the

date established for the receipt of bids. Where a reference standard has been revised and reissued after the date established for the receipt of bids and before performance of the work affected, notify the Architect in writing and request a decision on how to proceed. The Architect may issue a contract modification or an Architect's Supplemental Instruction (ASI) for proceeding in accordance with the updated standard.

2. The contractual relationship of the parties to the Contract shall not be altered from the contract documents by mention or inference otherwise in a reference standard. The provisions of the bidding requirements; contract documents including, but not limited to all issued addendums; and the Contract shall void the general, but not technical, provisions of a reference standard in conflict therewith.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 01420

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.

B. Temporary utilities include, but are not limited to, the following:

1. Water service and distribution
2. Temporary electric power and light
3. Temporary heat
4. Ventilation
5. Telephone service
6. Sanitary facilities, including drinking water
7. Storm and sanitary sewer

C. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds
2. Temporary roads and paving
3. Dewatering facilities and drains
4. Temporary enclosures
5. Hoists and temporary elevator use
6. Temporary project identification signs and bulletin boards
7. Waste disposal services
8. Rodent and pest control

9. Construction aids and miscellaneous services and facilities

D. Security and protection facilities include, but are not limited to, the following:

1. Temporary fire protection

2. Barricades, warning signs, and lights

3. Sidewalk bridge or enclosure fence for the site

4. Environmental protection

1.3 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Within fifteen (15) days of the date established for commencement of the work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements

2. Health and safety regulations

3. Utility company regulations

4. Police, Fire Department, and rescue squad rules

5. Environmental protection regulations

B. Standards: Comply with NFPA “Standard for Safeguarding Construction, Alterations, and Demolition Operations”; ANSI A10 Series standards for “Safety Requirements for Construction and Demolition”; and NECA Electrical Design Library “Temporary Electrical Facilities”.

1. Electrical Service: Comply with NEMA, NECA, UL Standards and regulations for temporary electric service. Install service in compliance with NFPA “National Electric Code”.

C. Permit and Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits, including all design and permit cost.

1.5 PROJECT CONDITIONS

A. Temporary Facilities: Field Offices, utility, and support infrastructure shall be installed no later than 30 days from Notice To Proceed.

B. Temporary Facilities and Utility: The Contractor is responsible for all design, permit, permit fee, installation, and use for all temporary facility, utility, power, gas, water, data, etc. used through the course of construction.

C. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner change over from use of temporary service to use of permanent service.

D. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

E. Project Identification and Signs: Provide within 30 days of NTP, and maintain for the life of the project, a project identification sign of the design, text and colors designated by the Architect, locate sign as approved by the Owner. Signs other than the specified sign will not be permitted, unless otherwise approved in advance by the Owner.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry.”

1. For job-built temporary offices, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.

2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sizes and thickness indicated.

3. For fences and vision barriers, provide minimum 3/8-inch (9.5-mm-) thick exterior plywood.

4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch - (16-mm-) thick exterior plywood.

C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.

D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral - surfaced roll roofing on roofs on job-built temporary offices, shops, and sheds.

E. Paint: Comply with requirements of Division 9 Section “Painting.”

1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.

2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.

3. For interior walls of temporary offices, provide 2 coats interior latex-flat wall paint.

F. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

G. Water: Provide potable water approved by local health authorities.

H. Open-Mesh Fencing: Provide 1.120-inch- (3-mm-) thick , galvanized 2-inch (50-mm-) chain-link fabric fencing 6 feet (2 m) high and galvanized steel pip posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch (19-mm-) heavy duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120- Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.

G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading. A separate temporary office with its own utilities is to be provided for School District personnel.

H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for design, layout, and installation of temporary facilities. Locate facilities where they will serve the project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required. All temporary facility design, permit, permit fees, and use fees are the responsibility of the contractor.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.

2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

3. Obtain easements to bring temporary utilities to the site where the Owner's easement cannot be used for that purpose.

4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

1. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

1. Install electric power service underground, except where overhead service must be used.

2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.

Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

E. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy

F. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

G. Temporary Data/Telephones: Provide temporary service throughout the construction period for all personnel engaged in construction activities. Install a separate line for each temporary office and first-aid station.

1. Provide one data line including WIFI Access for computer access to the Owner’s computer network in Owner’s Project Representative Field Office and pay costs for installation maintenance service and removal.

H. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the project’s needs.

1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

I. Drinking-Water Faculties: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.

1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degree F (7 to 13 degree C).

J. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.

2. Connect temporary sewers to the municipal system, as directed by sewer department officials.

3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.

K. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet (9 m) of building lines. Comply with requirements of NFPA 241.

C. Field Offices: Provide insulated, weather tight temporary offices of sufficient size to accommodate required School District, Architect and Construction Coordinator office personnel at the project site. Keep the office clean and orderly for use of small progress meetings. Size, Furnish and equip offices as follow:

1. Provide two distinctly secured office spaces (minimum 120sf each) each with 6x6 L desk and task chair, 4’ x 8’ plan table, plan rack, one (1) 6 shelf bookcase, tack board and dry erase board.

2. Provide 1 distinctly secured meeting space with conference table and chairs for minimum 12 personnel. Provide wall mounted 65” minimum size smart monitor with power and data as needed. Monitor to be turned over to owner at completion of project.

3. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.

4. Contractor to pay for all power, phone, data, fax, installations, set up, take down and monthly usage charges.

5. Sani-Hut to be placed by trailer.

D. Storage and Fabrication Sheds: Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters of fully enclosed spaces within the building or elsewhere on-site.

E. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Architect.

1. Paving: Comply with Division 2 Section “Hot-Mixed Asphalt Paving” for construction and maintenance of temporary paving.

2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.

3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.

4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.

5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.

F. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.

3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.

4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. (9.2 sq. m) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

H. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.

I. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when work is being performed.

J. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80 degrees F (27 deg C). Handle

hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

K. Rodent and Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures at regular intervals so the project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

L. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations.”

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.

4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chainlink fencing with post set in Masonry blocks.

F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

G. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Architect request that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.

3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

   a. Replace air filters and clean inside of ductwork and housing.

   b. Replace significantly worn parts and parts subject to unusual operating conditions.

   c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01500

SECTION 01600 – MATERIALS AND EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all contract documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements governing the Contractor's selection of products for use in the project.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 1 SECTION 01420 - REFERENCES specifies the applicability of industry standards to products specified.

2. Division 1 SECTION 01300 – SUBMITTALS specifies requirements for submittal of the Contractor's construction schedule and the submittal schedule.

3. Division 1 SECTION 01631 – SUBSTITUTIONS specifies administrative procedures for handling requests for substitutions made after award of the contract.

1.3 DEFINITIONS

A. Definitions used in this section are not intended to change the meaning of other terms used in the contract documents such as *Specialties, Systems, Structure, Finishes, Accessories* and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.

1. *Products* are items purchased for incorporation in the work, whether purchased for the project or taken from previously purchased stock. The term *Product* includes the terms *Material, Equipment, System* and terms of similar intent.

a. *Named Products* are items identified by the Manufacturer's product name, including make and model number or other designation, shown or listed in the Manufacturer's published product literature that is current as of the date of the contract documents.

b. *Foreign Products* as distinguished from domestic products are items substantially manufactured fifty percent [(50%) or more of value] outside the United States and its possessions. Products produced or supplied by entities substantially owned [more than fifty percent (50%)] by persons who are not citizens of, nor living within, the United States and its possessions.

2. *Materials* are products substantially shaped, cut worked, mixed, finished, refined or otherwise fabricated, processed or installed to form a part of the work.

3. *Equipment* is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 SUBMITTALS

A. Product List: A list of products required is included at the end of this section. Prepare a schedule in tabular form showing each product listed. Include the Manufacturer's name and proprietary product names for each item listed.

1. Coordinate product list with the Contractor's construction schedule and the schedule of submittals.

2. Form: Prepare product list with information on each item tabulated under the following column headings:

   a. Related Specification Section Number
   b. Generic name used in the contract documents
   c. Proprietary Name, Model Number and similar designations
   d. Manufacturer's Name and Address
   e. Supplier's Name and Address
   f. Installer's Name and Address
   g. Projected Delivery Date or time span of delivery period

3. Initial Submittal: Within thirty (30) days after date of commencement of the work, submit three (3) copies of an initial product list. Provide a written explanation for omissions of data and for known variations from the contract requirements.

   a. At the Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the contract period.

4. Completed List: Within sixty (60) days after date of commencement of work, submit three (3) copies of the completed product list. Provide a written explanation for omissions of data and for known variations from the contract requirements.

5. Architect's Action: The Architect will respond in writing to Contractor within two (2) weeks of receipt of the completed product list. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with the contract documents. The Architect's response will include a list of unacceptable product selections containing a brief explanation of reasons for this action.

1.5 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability or compatibility. When a determination has been made select products from sources producing products that possess these qualities to the fullest extent possible.

B. Compatibility of Options: When the Contractor is given the option of selecting between two (2) or more products for use on the project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each Prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate contactors.

2. If a dispute arises between Prime Contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the work:

1. No available domestic product complies with the contract documents.

2. Domestic products that comply with the contract documents are available only at prices or terms substantially higher than foreign products that comply with the contract documents.

D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer’s nameplate or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces, or where required for observation after installation, on accessible surfaces that are not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service connected or power operated equipment. Locate on an easily accessible

surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

a. Name of Product and Manufacturer
b. Model and Serial Number
c. Capacity
d. Speed
e. Ratings

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products according to the Manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

1. Schedule delivery to minimize long term storage at the site and to prevent overcrowding of construction spaces.

2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged or sensitive to deterioration, theft and other losses.

3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

4. Inspect products upon delivery to ensure compliance with the contract documents and to ensure that products are undamaged and properly protected.

5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

6. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.

7. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 – PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the contract documents that are undamaged and, unless otherwise indicated, new at the time of installation.

1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.

2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: The contract documents and governing regulations govern product selection. Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.

2. Semi Proprietary Specification Requirements: Where specifications name two (2) or more products or manufacturers, provide one (1) of the products indicated. No substitutions will be permitted.

   a. Where specifications specify products or manufactures by name, accompanied by the term “or equal” or “or approved equal.” Comply with the contract document provisions concerning *Substitutions* to obtain approval for use of an unnamed product.

3. Non-Proprietary Specifications: When specifications list products or manufacturers that are available and may be incorporated in the work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with contract requirements. Comply with contract document provisions concerning *Substitutions* to obtain approval for use of an unnamed product.

4. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with contract requirements.

5. Performance Specification Requirements: Where specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.

a. Manufacturer's recommendations may be contained in published product literature or by the Manufacturer's Certification of Performance.

6. Compliance with Standards, Codes, and Regulations: Where specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.

7. Visual Matching: Where specifications require matching an established sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

   a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the contract documents concerning *Substitutions* for selection of a matching product in another product category.

8. Visual Selection: Where specified product requirements include the phrase "…as selected from Manufacturer's standard colors, patterns, textures…" or a similar phrase, select a product and Manufacturer that comply with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.

9. Allowances: Refer to individual specification sections and *Allowance* provisions in Division 1 for allowances that control product selection and for procedures required for processing such selections.

PART 3 – EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with Manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work.

   1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600

SECTION 01631 - SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 1 SECTION 01420 - REFERENCES specifies the applicability of industry standards to products specified.

2. Division 1 SECTION 01300 - SUBMITTALS specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

1.3 DEFINITIONS

A. Definitions in this article do not change or modify the meaning of other terms used in the contract documents.

B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the contract documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:

1. Substitutions requested during the bidding period, and accepted by addendum prior to award of the Contract, are included in the contract documents and are not subject to requirements specified in this section for substitutions.

2. Revisions to the Contract Documents requested by the Owner or Architect.

3. Specified options of products and construction methods included in the contract documents.

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: The Architect will consider requests for substitution if received within sixty (60) days after commencement of the work. Requests received more than sixty (60) days after commencement of the work may be considered or rejected at the discretion of the Architect.

1. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals and include the Product Evaluation Questionaire (CP-F116) found within these bid documents.

2. Identify the product or the fabrication or installation method to be replaced in each request. Include related specification section and drawing numbers.

3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

a. Coordination information, including a list of changes or modifications needed to other parts of the work and to construction performed by the Owner and separate contractors, that will be necessary to accommodate the proposed substitution.

b. A detailed comparison of significant qualities of the proposed substitution with those of the work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.

c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

d. Samples, where applicable or requested.

e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

f. Cost information, including a proposal of the net change, if any in the Contract Sum.

g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.

h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

4. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one (1) week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within three (3) weeks of receipt of the request, or two (2) weeks of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.

    a. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.

1. Extensive revisions to the contract documents are not required.

2. Proposed changes are in keeping with the general intent of the contract documents.

3. The request is timely, fully documented, and properly submitted.

4. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.

5. The request is directly related to an “or-equal” clause or similar language in the contract documents.

6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.

7. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.

9. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.

10. The specified product or method of construction cannot provide a warranty required by the contract documents and where the Contractor certifies that the proposed substitution provides the required warranty.

B. The Contractor's submittal and the Architect's acceptance of shop drawings, product data, or samples for construction activities not complying with the contract documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01631

PRODUCT EVALUATION QUESTIONNAIRE

When proposing to substitute products for those specified or proposing a product to meet a specified performance standard, please furnish the following information to assist the Owner and Architect in evaluating the proposed product.

Bid/Quote #: _____

Project: _____

Specification Section: _____

Division:_____

Article #: _____

Name of Product: _____

Manufacturer's Name and Address: _____

_____

1. Attach manufacturer's complete technical data and all information relating to limitations of the product information requiring further testing be deemed necessary by the Architect, the cost of the prescribed test shall be borne by the Contractor. Contractor shall send product samples upon request.

2. Attach a list of projects where comparable use has been made of this product. List the name and location of the project, name of Owner or Architect, Engineer, General Contractor, and Subcontractor (if applicable), and the year installed.

3. List any problems encountered with this product on projects where it has been used. What corrective measures were required?

4. Provide a detailed comparison of the proposed substitute product with that of the specified product. Differences are to be highlighted and called out.

5. Submit a detailed specification, conforming to the format of the technical specifications herein contained, tailored to this project for installation of this product.

6. Will the services of an expert field representative be furnished to supervise the installation of this product?

7. Describe maintenance requirements for this product and availability of expert repair service, if needed.

8. Will the proposed substitution result in a change in Contract price or time of completion? If so, submit itemization of price change and explain effect on time of completion.

9. Will the use of the proposed product necessitate a change in the contract drawings or specifications?

10. Will the use of this product necessitate the payment of any license fees or royalties?

11. Furnish information establishing financial responsibility of the manufacturer. (Number of years in business, volume of business, Dunn & Bradstreet rating, etc.)

12. The Contractor certifies that he or she understands the conditions of use to which this product will be put and he/she warrants this product as stipulated in the General Conditions.

_____
Name of Contractor

_____
Signature of Officer, Owner or Partner

_____
Date

SECTION 01650 - CONTRACTOR MOVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes administrative and supervisory requirements necessary for coordinating construction contractor moving requirements including, but not necessarily limited to, the following:

1. General Project Coordination Procedures

2. Conservation

3. Coordination Drawings

4. Administrative and Supervisory Personnel

5. Cleaning and Protection

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 1 SECTION 01200 – PROJECT MEETINGS for progress meetings and coordination meetings.

2. Division 1 SECTION 01300 - SUBMITTALS for preparing and submitting the Contractor's construction schedule.

1.3 OWNER RESPONSIBILITIES

A. The Owner shall complete all of the preparatory work required for the moving of furnishings, equipment, files, etc. as listed below:

1. Supply boxes, tape and box labels.

2. All personal property is the responsibility of WCSD.

3. All WCSD property that will fit in the WCSD provided boxes are to be boxed.
4. All file cabinets, desks, shelves and closets are to be emptied.

5. All loose trash shall be picked up and disposed of.

6. Inform school of time frames and schedules.

7. Coordinate staging area for temporary storage containers with site, as required.

8. All items will be ready to move based upon the Contractor's approved schedule.

1.4 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall be responsible for moving all furnishings, equipment, files, etc. as directed by the Owner and listed above and all of the items as listed:

1. Hire movers and manage all aspects of the move.

2. Supply all required moving tools, dollies, hand trucks, carts, etc.

3. Supply steel lockable temporary storage containers, if required.

4. Photograph the space prior to moving out.

5. Replace all items in space as indicated on photographs.

6. Repair or replace any WCSD owned property damaged by the Contractor.

7. Disconnect and reconnect, as needed, any computer, audio, copy and print equipment, etc.

1.5 COORDINATION

A. Coordinate the construction operations included in various sections of these specifications to assure efficient and orderly installation of each part of the work. Coordinate the construction operations included under different sections that depend on each other for proper installation, connection and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
3. Make provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination, include such items as required such as, notices, reports and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules

2. Installation and removal of temporary facilities

3. Delivery and processing of submittals

4. Progress meetings

5. Project closeout activities

D. Conservation: Coordinate moving operations to assure that operations are carried out with consideration given to conservation of energy, water and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work.

E. Intent of Drawings:

1. The work of the Contractor and any applicable sub-contractors shall conform to the intent of the architectural and moving coordination work as reviewed by the Architect. Drawings are partly diagrammatic and do not intend to show in detail all features of the work. The Contractor shall carefully review the work to be performed by other trades, compare related drawings and shall thoroughly understand the moving responsibilities affecting their work.

2. All changes required in the work caused by failure to do so shall be at no expense to the Owner.

F. Moving Coordination Drawings:

1. Floor Plans and Wall Elevations shall include dimensioned sizes and locations for all door and window openings.

1.6 SUBMITTALS

A. Coordination Drawings: Prepare moving coordination drawings where careful coordination is needed for installation of products, materials and equipment to be relocated and stored.

1. Show the relationship of components shown on separate Shop Drawings.

2. Indicate required installation sequences. Acknowledge the Contractor's responsibilities in written fashion.

3. Comply with requirements contained in Division 1 SECTION 01300 - SUBMITTALS.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the mover of each component to inspect the conditions under which the work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 CLEANING AND PROTECTION

A. Clean and protect material and equipment during handling and installation. Apply protective covering, where required, to assure protection from damage or deterioration at the time of Substantial Completion.

B. Clean and provide maintenance on moved and stored work as frequently as necessary through the remainder of the construction period.

C. Limiting Exposures: Supervise construction operations to assure that no part of the relocated work completed or in progress, is subject to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading

2. Excessive internal or external pressures

3. Excessively high or low temperatures
4. Thermal shock
5. Excessively high or low humidity
6. Air contamination or pollution
7. Water or ice
8. Solvents
9. Chemicals
10. Light
11. Radiation
12. Puncture
13. Abrasion
14. Heavy traffic
15. Soiling, staining and corrosion
16. Bacteria
17. Rodent and insect infestation
18. Combustion
19. Electrical current
20. High speed operation
21. Improper lubrication
22. Unusual wear or other misuse
23. Contact between incompatible materials
24. Destructive testing
25. Misalignment

26. Excessive weathering
27. Unprotected storage
28. Improper shipping or handling
29. Theft
30. Vandalism

END OF SECTION 01650

SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all bid documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for Contract closeout including, but not limited to, the following:

1. Inspection Procedures
2. Submittal of Project Record Document
3. Submittal of Operation and Maintenance Manual
4. Submittal of Warranties
5. Final Cleaning
6. Submittal of Regulated Systems [ACBM (Asbestos Containing Building Materials) & Lead] Closeout Documents
7. Submittal of any Final Prevailing Wage Reports

B. Closeout requirements for specific construction activities are included in the appropriate sections in Divisions 2 through 16.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show one hundred percent (100%) completion for the portion of the work claimed as substantially complete.

    a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the contract sum.

    b. If one hundred percent (100%) completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.

c. Provide a list of all warranties, provide warranty duration, complete contract information of firm, and name of individual who will be performing work – post one (1) year. extended warranties will be submitted on a separate spread sheet within the closeout documents in the following format. Specification #, Company responsible for performing the warranty work, Local contact for responsible individual, phone number and email address, warranty description, warranty period, warranty start and end dates.

2. Advise the Owner of pending insurance changeover requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities.

5. Include occupancy permits, operating certificates, and similar releases.

6. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.

7. Submit all required training meeting minutes and video recordings of all training courses.

8. Deliver tools, spare parts, extra stock, and similar items.

9. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.

10. Complete startup testing of systems and videoed training instruction of/for the Owner's Operation and Maintenance personnel.

11. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.

12. Complete final clean-up requirements, including touch up painting.

13. Touch-up and otherwise repair and restore marred, exposed finishes.

14. Provide Contractor furnished fixtures, furnishings, and equipment individually valued over $5,000 including description, manufacturer model and serial number, location at site, and specific value for equipment.

15. Provide comprehensive list of all fuel burning equipment including description, manufacturer model and serial number, location at site, and value of equipment.

B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Architect will repeat inspection when requested and assured that the work is substantially complete.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

3. The cost for any Architectural services for reinspection is the Contractor’s sole responsibility.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the WCSD’s, Architect's & Engineer’s final inspection lists of items to be completed or corrected, endorsed, and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.

4. Submit consent of surety to final payment.

5. Submit a final liquidated damages settlement statement.

6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

7. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took

possession of and assumed responsibility for corresponding elements of the work.

B. Reinspection Procedure: The Architect will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.

1. Upon completion of reinspection, the Architect will prepare a Certificate of Final Acceptance. If the work is incomplete, the Architect will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

2. If necessary, reinspection will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set black line white prints of Contract Drawings and Shop Drawings or continuous live electronic as built drawings with appropriate mark ups. Mark the set to show the actual installation where the installation varies from the work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. At the conclusion of the project, this record set of prints shall be submitted to the Architect for his/her review and comment. If the record set of prints is found to be complete and accurate, the prints shall be returned to the Contractor for submittal to the Owner with other closeout documents.

Record drawings must be reviewed and approved prior to each pay request by the Owner’s representative. The drawings should reflect the work that has been accomplished during the time period of the pay request. Lack of record drawings approval at the time of submittal of a pay request will result in a potential delay in the processing of the pay request.

1. Mark record sets with red erasable pencil or electronic. Use other colors to distinguish between variations in separate categories of work.

2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.

3. Note related change order numbers where applicable.

4. Organize record drawing sheets into manageable sets.

5. Provide one Bound set of record drawings with durable paper cover sheets; print suitable titles, dates and other identification on the cover of each set.

6. . Provide record drawings using electronic media, including one PDF and one Auto Cad compatible. Original media will be provided for Contractor to make required record drawing notations.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual, one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.

   Record specifications must be reviewed and approved prior to each pay request by the Owner's representative. The specifications should reflect the work that has been accomplished during the time period of the pay request. Lack of record specification approval at the time of submittal of a pay request will result in a potential delay in the processing of the pay request.

   1. Mark these documents to show substantial variations in actual work performed in comparison with the text of the specifications and modifications.

   2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.

   3. Note related record drawing information and product data.

   4. Upon completion of the work, submit an electronic record specifications to the Architect for the Owner's records.

D. Record Product Data: Maintain one (1) copy of each Product Data submittal. Note related Change Orders and markup of record drawings and specifications.

   1. Mark these documents to show significant variations in actual work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.

   2. Give particular attention to concealed products and portions of the work that cannot otherwise be readily discerned later by direct observation.

3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.

E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the project site to determine which samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's sample storage area.

F. Miscellaneous Record Submittals: Refer to other specification sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or electronic file, ready for continued use and reference. Submit to the Architect for the Owner's records.

G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind 2 copies (1 hard copy / 1 electronic) properly indexed data in individual, heavy duty, 2-inch, 3-ring, vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions
2. Spare parts list
3. Copies of warranties
4. Wiring diagrams
5. Recommended turn around cycles
6. Inspection procedures
7. Shop Drawings and Product Data
8. Fixture lamping schedule
9. Any other applicable information

H. Warranty Manuals: organize warranty data into suitable set of manageable size, Bind 1 copy and 1 electronic properly indexed in individual, heavy duty 3 ring binder. Mark appropriate identification on front and spine. Include the following types of information:

1. All products with extended warranties beyond 1 year, including duration (start and end date, similar to what is described in 1.3, A, 1,c)

2. Manufacturer

3. Model / Serial where applicable

4. Manufacturer contact information

I. Provide one complete download of all Procore Files properly organized and linked in PDF versions. Contractor to ensure original Procore file and documentation remains in place on Procore for use by owner. Owner shall instruct the contractor of the proper file structure

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Film Document each training and demonstration. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals

2. Record documents

3. Spare parts and materials

4. Tools

5. Lubricants

6. Fuels

7. Identification systems

8. Control sequences

9. Hazards

10. Cleaning

11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up
2. Shut down
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments
7. Effective energy utilization

END OF SECTION 01700

SECTION 01710 - FINAL CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all contract documents and addendums associated with this project shall apply to this section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for final cleaning at Substantial Completion.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 1 SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS specifies general cleanup and waste removal requirements.

2. Division 1 SECTION 1700 – CONTRACT CLOSEOUT specifies general contract closeout requirements.

3. Special cleaning requirements for specific construction elements are included in appropriate sections of Divisions 2 through 16.

C. Multiple Prime Contracts: Each Prime Contractor is responsible for final cleaning their own work. The Contractor for General Construction is responsible for coordinating final cleaning of an area or piece of equipment where more than one (1) Prime Contractor is involved.

D. Environmental Requirements: Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and antipollution regulations.

1. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.

2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents

that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final-cleaning operations to all work spaces and any adjacent spaces affected by the work performed. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.

1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and foreign substances.

2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

3. Remove petrochemical spills, stains, and other foreign deposits.

4. Remove tools, construction equipment, machinery, and surplus material from the site.

5. Remove snow and ice to provide safe access to the building.

6. Clean exposed exterior and interior hard surfaced finishes to a dirt free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition. Wax any required flooring to the District standard.

7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

8. Broom clean concrete floors in unoccupied spaces.

9. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo, if required.

10. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

11. Remove labels that are not permanent labels.

12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

14. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

16. Clean ducts, blowers, and coils if units were operated without filters during construction.

17. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.

18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.

19. Leave the Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities. This section is only applicable for a new facility or an addition to an existing facility.

D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.

E. Compliances: Comply with regulations of Authorities Having Jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 01710

Technical Specifications
Volume 1

Washoe County School District
New STEAM/Media Building & Site Improvements at Libby Booth Elementary School

100% Construction Documents
August 28, 2026

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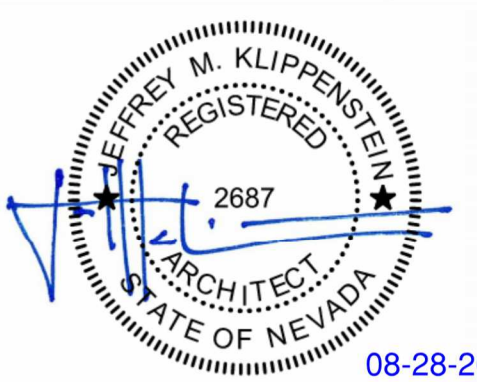
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SECTION 00 00 01 – PROJECT DIRECTORY

August 28, 2026

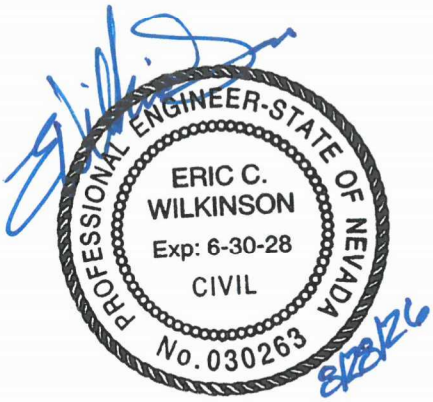
OWNER
Washoe County School District
Capital Projects and Planning
14101 Old Virginia Road
Reno, NV 89521
(775) 789-3840

ARCHITECTURE
H+K Architects Ltd.
Jeff Klippenstein, AIA
50 Washington Street #200
Reno, NV 89503
(775) 332-6640

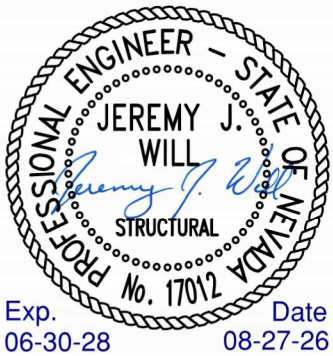


08-28-26

CIVIL ENGINEERING
Odyssey Engineering
Eric Wilkinson, P.E.
895 Roberta Lane, Suite 104
Sparks, NV 89431
(775) 359-3303



STRUCTURAL ENGINEERING
Will Engineering, LLC
Jeremy Will, S.E.
748 S. Meadows Pkwy, Suite A-9
PMB #21
Reno, NV 89521
(775) 560-6554



Exp. 06-30-28 Date 08-27-26

MECHANICAL ENGINEERING

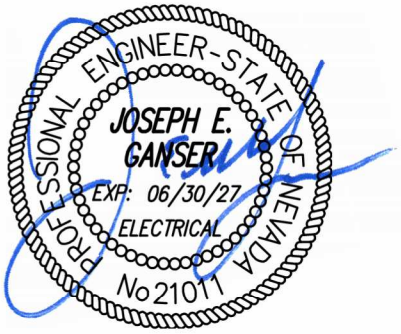
Ainsworth Associates
Alison Hall, P.E., LEED AP BD+C, CPD
1420 Holcomb Ave., Suite 201
Reno, NV 89502
(775) 329-9100



08/27/2026

ELECTRICAL ENGINEERING

PK Electrical, Inc.
Joey Ganser, P.E.
681 Sierra Rose Drive, Suite B Reno, NV 89511
(775) 826-9010



08/27/2026

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SECTION 01 81 00 – SUPPORT AND LATERAL FORCE RESTRAINT OF NON-STRUCTURAL COMPONENTS, UTILITIES, AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide engineered vertical support and lateral restraint for non-structural systems supported by the structure including but not limited to Architectural Components, Fire Suppression Piping and Equipment, Electrical Equipment, Electrical Raceway, Plumbing Piping and Equipment, Mechanical Piping, Process Piping, HVAC Duct, Mechanical Equipment, Mechanical Curbs, and utilities in compliance with the currently adopted version of the International Building Code (IBC) and with local building code amendments.

B. At vertical support and lateral restraint installation locations, provide structural systems engineered to accommodate dead load, live load, seismic force, and wind force reactions.

1.2 RELATED SPECIFICATION SECTIONS

Division 11: Equipment
Division 13: Special Construction
Division 21: Fire Suppression
Division 22: Plumbing
Division 23: Heating Ventilation and Air Conditioning
Division 26: Electrical

1.3 REFERENCES

A. Publications, codes, and standards listed below form a part of this specification to the extent referenced.

1. Currently adopted version of the International Building Code (IBC)
   Chapter 16 - Structural Design,
   Chapter 17 – Structural Tests And Special Inspections
2. ASCE 7-22, Minimum Design Loads For Buildings and Other Structures, American Society of Civil Engineers (ASCE).
3. ACI 318, Building Code Requirements for Structural Concrete, American Concrete Institute (ACI).

1.4 COMPONENT IMPORTANCE FACTOR

A. Components shall be assigned a component importance factor, I_p, in accordance with ASCE 7, Chapter 13.

1.5 SUBMITTALS

A. Provide Dead and Live Load calculations as required by ASCE 7-22 and the equipment manufacturer stamped by a registered civil or structural engineer licensed to practice in Nevada.

B. Provide Wind and Seismic Design Force calculations per ASCE 7-22 stamped by a registered civil or structural engineer licensed to practice in Nevada.

C. Submit vertical support and lateral restraint plans stamped by a registered civil or structural engineer licensed to practice in Nevada. Plans to show:

1. All vertical support, anchorage for wind and seismic, and brace locations.
2. All vertical support and anchorage connections to structure including anchor brand, type, quantity, and size.
3. Vertical support and brace reaction point load at all connections to structure for review by engineer of record in checking suitability of the building structure to accommodate imposed loads.
4. Plan sheets showing appropriate installation details reflecting actual job site conditions.
5. Maximum Allowable Size or Equipment/Utility Weight (lbs, lbs/lf).
6. Minimum Vertical Support Size and Material (Steel Grade, Rod Diameter, Strap Width and Gauge, etc).
7. Vertical Support Total Vertical Load.
8. Supplemental framing materials, sizes, locations (strut, angles, etc.) and method of attachment.
9. Maximum Allowable Transverse Brace Spacing.
10. Transverse Brace Reaction.
11. Maximum Allowable Longitudinal Brace Spacing.
12. Longitudinal Brace Reaction.
13. Minimum Required Seismic Restraint Brace Arm Assembly.
14. Minimum Required Seismic Restraint Anchorage Structure.
15. Installation Detail Drawing References.

PART 2 - PRODUCTS

2.1 CODE APPROVALS

A. Anchorage and support products shall have ICC or equivalent approval for use under the conditions, exposure, load type, force magnitude, and substrate in which they shall be used.

B. Anchorage products in concrete shall be approved for use in cracked concrete as required by ACI 318.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Supports, restraint, and anchorages to be per the approved submittals and product manufacturer requirements.

3.2 EQUIPMENT CONNECTIONS

A. Components crossing structural joints, where relative movement due to wind or seismic forces may occur, shall include movement joints designed to accommodate movement defined by ASCE 7, and as delineated in the Construction Documents.

3.3 SPECIAL INSPECTION

A. Special Inspection Requirements:

All Designated Seismic Systems are subject to Special Inspection per IBC Chapter 17. The Lateral Force Restraint Engineer shall provide a special inspection plan to the Contractor for

submittal to the Owner and Design Team for use by the project's Special Inspector. The plan will include the following:

1. A list of all components of the vertical support seismic system that require inspection or testing.
2. The required frequency of testing and inspection.
3. Type and nature of testing required.

B. Special inspection for mechanical and electrical components shall be provided as follows:

1. For all Designated Seismic Systems within seismic design categories D, E or F.
2. Periodic special inspection during the anchorage of electrical equipment for emergency or standby power systems in structures assigned to Seismic Design Categories C, D, E or F.
3. Periodic special inspection during the installation of anchorage of all other electrical equipment in Seismic Design Categories E or F.
4. Periodic special inspection during the installation for flammable, combustible or highly toxic piping systems and their associated mechanical units in Seismic Design Categories C, D, E or F.
5. Periodic special inspection during the installation of HVAC ductwork that will contain hazardous materials in Seismic Design Categories C, D, E or F.
6. Periodic special inspection during the installation of vibration isolation systems where the construction documents indicate a maximum clearance (air gap) between the equipment support frame and restraint less than or equal to 1/4 inch.

C. Install identification tags at all seismic brace locations. Tags to include the following information:

1. Specific seismic forces the location was designed to resist.
2. Maximum brace reaction at connection to structure.
3. For single hung items, the maximum pipe/conduit size the brace location was designed to accommodate.
4. For trapeze supported items, the maximum weight (lbs/lf) the brace location was designed to accommodate.
5. For suspended equipment, the maximum unit operating weight (lbs) the brace location was designed to accommodate.
6. Location identifier cross matched to that on plan set layout.
7. Company name of installing contractor.

D. Upon completion of construction, a Quality Assurance Representative of the Lateral Force Restraint Engineer shall review the installation of the seismic-force-resisting system and provide documentation indicating general conformance to seismic restraint layout drawing.

END OF SECTION 01 8 100

SECTION 03 10 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Requirements:

1. Drawings and general provisions of the Contract Documents including General, Special and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. General Scope of Work:

1. Provide formwork and accessories in accordance with provisions of this Section for cast-in-place concrete shown on the Drawings or required by other Sections of these Specifications.

C. Related work:

1. Section 03 20 00: Concrete reinforcement.
2. Section 03 30 00: Cast-in-place concrete.
3. Section 03 45 00: Concrete Finishing.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Design of formwork is the Contractor's responsibility.

C. Standards:

1. Concrete work shall comply with the requirements of ACI 301, “Specifications for Structural Concrete for Buildings”, latest edition.
2. Items not otherwise specified shall comply with ACI Standard 347, “Recommended Practice for Concrete Formwork”, latest edition.

D. Allowable Tolerances in Formwork:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347.
2. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
3. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.
4. Refer to Structural Drawings for additional requirements.

E. Inspections:

1. See drawings and general provisions of the Contract Documents including General, Special and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.
2. See requirements for inspection as stated in Part 3 of this section.

1.3 SUBMITTALS

A. Submit manufacturer’s specifications and installation instructions for products specified. Include manufacturer’s certification as may be required to show compliance with these specifications.

1.4 JOB CONDITIONS

A. LOADING STRUCTURES

1. Protect all in-place structures from excessive loading.
2. Shore and brace as necessary to prevent all damage.

B. SCHEDULING

1. Contractor shall provide and erect sufficient forms so that the work of placing concrete will proceed at a rate to insure maintaining a schedule so that the time of the inspector shall be as continuous as practicable.

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL

1. Except for metal forms, use new materials. Materials may be re-used during progress of the Work, provided they are completely cleaned and reconditioned, recoated for each use, and capable of producing formwork of the required quality.

B. EARTH FORMS

1. Side forms for footings may be omitted, and concrete may be placed directly against excavation, only when requested by Contractor and approved by Architect, in writing. The Architect shall be the sole authority for making this approval.
2. When omission of forms is accepted, provide additional concrete 1” on each side of the minimum design profiles and dimensions shown on Structural Drawings.

C. FORM MATERIALS

1. Plywood:
   a. APA Exterior “B-B” “Plyform” grade Douglas Fir veneer panel with medium density overlaid one side grade; sound, undamaged sheets with clean, true edges; conform to Product Standard PS 1. Use for all exposed concrete surfaces.

b. Panel thickness and placing as required to support concrete in accordance with referenced standards; minimum ¾" thickness.
c. All panels edge sealed; Both faces of general use panels shall be factory sealed with colorless coating which will not affect application of applied finishes or protective coatings; form oil not permitted.

2. Lumber for Forms:
   a. For concealed concrete surfaces including footings and foundations, use "Standard" or better grade Douglas Fir, T&G or shiplap, surface 1 side, 2 edges, not wider than 8", secured to wood or steel stakes, substantially constructed to shapes indicated and to support the required loads.
   b. For studs, wales, and supports, use S4S surfaced "Standard" or better grade Douglas Fir lumber, dimensions as required to support the loads, but not less than 2x4 inch size.
3. Flat Steel Forms:
   a. Approved type steel forms may be used in lieu of wood and plywood, at the Contractor's option.
4. Tube Forms:
   a. For round columns furnish fiber, fiberglass, or metal tube forms of diameters required, capable of withstanding continuous pour full height and providing a finished surface free of spiral markings.

B. ACCESSORIES

1. Form Ties:
   a. Removable form bolts with coil ties, or snap ties.
   b. Either system shall have cone spreaders and tie metal shall be ¾" minimum back of concrete face.
   c. As manufactured by Superior Concrete Accessories, Burke, Richmond, or equal.
2. Screed Chairs:
   a. Approved type for slab screeds.
3. Chamfer Strips:
   a. Wood or PVC strips, ¾ x ¾ inch size of maximum possible lengths.
4. Control Joints:
   a. For interior slabs, provide by sawcutting.
   b. Where specified by the Architect, furnish cast-in-place control joints: Greenstreak Plastic Products "Zipcap Control-joint Former, W.R. Meadows SPEED-E-JOINT, or equal, minimum 10-foot lengths, 1" depth for installation in new interior slabs.
5. Expansion Joints:
   a. For Interior Slabs: ½" thick by depth of slab less ¼", conforming to ASTM D1752, Type 3 (AASHTO M153-Type II), Meadows "Seal Tight" self-expanding cork, A.P.S Self-Expanding Cork, or equal.
6. Waterstops:
   a. Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50° F to plus 175° F working temperature range, 4" wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; Greenstreak, J.P. Specialties Earth Shield, or equal.
7. Nails, Spikes, Lag Bolts, Thru-Bolts, Anchorages:
   a. Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
8. Joint Sealant:
   a. As specified in Section 03 30 00.
9. Form Saver Splices:

a. Form saver splices shall develop 125% of the specified yield strength of the bar being spliced and shall be Dayton Superior D51A with D51 threaded bar, nVent Lenton Form Saver, or equal.

E. TREATMENT OF FORMS

1. Furnish W. R. Meadows, Inc. “Sealtight Duogard”, Nox-crete Chemical “Nox-crete Form Coating”, or equal, guaranteed as non-staining and not impairing bond of paints or other coatings.
2. Form release agent may be factory-applied provided release agent conforms to these requirements; form oil not permitted.

2.2 DESIGN OF FORMWORK

A. General:

1. Design formwork so it will safely support vertical and lateral loads that might be applied. Design forms and falsework to include factors pertinent to safety of the structure during construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

B. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Install concrete work in accordance with ACI 301 except as amended by this Section.

B. Earth Forms:

1. Where permitted, hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete. Provide additional concrete 1” on each side of the minimum footing dimensions shown on the Structural Drawings.

C. Construction - Formwork:

1. General:
   a. Construct formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 347. Construct so concrete members and structures are of correct sizes, shapes, lines, and dimensions shown, and as

required to obtain accurate alignment, location, grades, level, and plumb work in the finished structure.

b. Make reasonably tight to prevent excess leakage of cement paste during concrete placement. Solidly butt joints, and provide backup material at joints as required to prevent leakage and prevent fins. Provide bracing to ensure stability of formwork.
c. Shore or strengthen formwork subject to over-stressing by construction loads.
d. Shoring is required for any reinforced concrete structural component, except concrete slabs supported by structural steel framing U.N.O.
e. Set form board and plywood for walls horizontally; keep form joints to a minimum.
f. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features as required.
g. Remove debris and clean out forms before pouring any concrete.
h. Keep forms moist prior to pour to prevent shrinkage and warping.
i. Do not damage concrete during stripping. Permit removal of remaining principal shores.

2. Fabrication:
   a. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
   b. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
   c. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
   d. Locate studs and joists not farther apart than 12 inches o.c. Horizontal form wales spaced not to exceed 2 feet o.c.
3. Form Ties:
   a. Hold inner and outer forms for vertical concrete together with combination steel ties and spreaders as approved by Architect.
   b. Space wall form ties not over 4 feet apart horizontally and 2 feet apart vertically. Space ties symmetrically in tiers and rows, each tier plumb from top to bottom and each row level. Form tie placement in formed walls where wall surface will be left exposed in the finished work, shall be uniformly spaced and aligned within the following tolerance:
      1) Tie alignment, horizontally and vertically along each wall plane, shall occur no more than ¼” from a straight line measured between first and last tie along any line, and no more than ¼” variance in alignment between any to adjacent ties.
   c. At horizontal pour lines, locate ties not more than 6” below the pour lines. Tighten after concrete has set and before the next pour is made.
   d. For exposed concrete surfaces, install form ties of removable type with she-bolts equipped with permanent plugs and a system approved by Architect for fixing the plug in place.
4. Forms for Exposed Concrete:
   a. Drill forms to suit ties being used, and to prevent leakage of cement paste around the holes. Do not splinter forms by driving ties through improperly prepared holes.
   b. Provide sharp clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
   c. Use extra studs, wales, and bracing to prevent objectionable bowing of forms between studs, and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.
5. Column Forms:
   a. For square or rectangular columns, use 2” thick planks or joists, surfaced one side and two edges; or use metal forms.

b. For round columns, use tube forms as specified above, which will impart a smooth architectural finish as directed and approved by Architect.
c. Construct column forms with tight joints and securely clamped together with steel clamps.

6. Corner treatment:
   a. Chamfer salient corners in exposed concrete unless otherwise noted or where flush with adjacent surfaces. Unless shown otherwise, form chamfers with 3/4" x 3/4" strips, accurately formed and surfaced to produce uniformly straight lines and tight edges.
   b. Extend terminal edges to required limit and miter the chamfer strips at changes in direction.
7. Provisions for Other Trades:
   a. Provide openings in concrete formwork to accommodate work of other trades.
   b. Verify size and location of openings, recesses, and chases with the trade requiring such items.
   c. Accurately place and securely support items to be built into the concrete.
8. Re-use of Plywood:
   a. Plywood forms may be reused provided damaged edges are removed, imperfections in faces are repaired and holes filled and plywood is cleaned to obtain concrete surfaces equal to that obtained by new plywood.

D. TREATMENT OF FORMS

1. Before placing the concrete, the contact surfaces of forms shall be coated with a suitable non-staining form coating compound or shall be given two coats of nitrocellulose lacquer. Mineral oil shall not be used on forms.
2. Excess coating shall be removed by wiping with cloths. Re-used forms shall have the contact surfaces cleaned thoroughly, those which have been coated shall be given an additional application of the coating.
3. Apply form coating material in strict accordance with manufacturer’s recommendations.

E. MISCELLANEOUS EMBEDDED ITEMS

1. Anchor Bolts:
   a. Set as required on the drawings.
2. Inserts, Sleeves, Conduit and Similar:
   a. Allow all trades time and facilities to install.
   b. Conform to Section 503 of ACI Building Code and the International Building Code.
   c. General Contractor shall furnish and install all sleeves and frames for openings shown on drawings or required for equipment, except those sleeves specified under the Mechanical and Electrical Work.
3. CIP Hanger and Connector Inserts:
   a. Install per Manufacturer and Code Report requirements.
4. Hangers for Suspended Ceilings:
   a. Install pigtail hangers consisting of No. 8 galvanized wire with two loops turned on end and embedded 1-1/2” in concrete, for suspended ceiling system specified in Division 9.
   b. Contractor may submit alternate types of anchors for embedding in concrete to Architect for approval.
   c. Particular care is required in location of hangers to preserve module throughout.
5. Elevator Inserts:
   a. Set inserts for rail bracket supports; furnished by elevator subcontractor.
6. Ceiling and Wall Inserts:

a. Exact locations and alignment essential.
b. Drill forms for inserts; install with bolts and washers.
c. Bolt through form into inserts.

7. All Other Miscellaneous Items:
   a. Build-in items specified in other Sections exactly where shown.
   b. Verify locations which may be critical.

F. JOINTS AND STOPPAGES

1. Construction Joints:
   a. Install in accordance with ACI 318 and as specified herein. Located where indicated or otherwise required and approved as to not impair strength of structure.
   b. Provide nominal ¾" x 2-1/2" key at construction joints, unless otherwise shown on drawings, or as directed by Structural Engineer.
   c. Make joints perpendicular to principal reinforcement. Continue half reinforcement and mesh across joints except at isolation joints; provide longitudinal keys at least 1-1/2" deep at all joints in walls and between walls and slabs or footings.
   d. Remove key-forming wood inserts and thoroughly clean surface of concrete at all joints, removing all laitance, before placing next lift.
   e. Immediately prior to placing next lift and/or adjacent slab, dampen hardened concrete of joint surface and coat with neat cement mortar of similar proportions to mortar in concrete.
2. Expansion Joints:
   a. Do not extend reinforcement through where bonded on both sides of joint; smooth dowels may extend through joint. Position accurately and support against displacement in locations listed hereinafter.
   b. Interior Work:
      1) Install isolation/expansion joints between interior ground-supported slabs and building foundation walls when shown on Drawings, and at other locations where specifically shown or noted.
      2) Install joints with top surface recessed below finish elevation ¼", and fill with joint sealer as specified in Section 03 30 00, finished flush with slab surface.
   c. Exterior Work:
      1) Install as required in new walks and slabs in locations and/or spacings shown, elsewhere not more than 10 feet apart. Coordinate exact locations and alignment with Architect.
      2) Install expansion joints between concrete walks/slabs and vertical building walls and retaining walls.
      3) Install at all other locations indicated.
      4) Install joints with top surface recessed below finish elevation ¼", and fill with joint sealer as specified in Section 03 30 00, finished flush with slab surface.
3. Control Joints:
   a. Provide as detailed and in locations indicated, accurately placed to true straight lines and supported against displacement.
   b. For exterior work, form with edging tool as specified in Section 03 30 00.
   c. For interior work, build control strips into forms, install tooled joints, or diamond-saw cut joints 1/8" wide by 1/5 the depth of the slab.
      1) If saw cut method is used, saw cutting shall be performed as soon as the concrete hardens sufficiently to prevent raveling of the concrete at the edges and before the concrete temperature is permitted to fall; perform cuts 4 – 8 hours after concrete is placed, as soon as the freshly placed concrete can be walked on.

2) Contractor shall have at least one spare saw available during the saw cutting operation.

G. REMOVING FORMS AND SHORING

Conform to the following, unless specified otherwise in Structural Notes.

1. Ties:
   a. Remove 4 days after pour. Fill holes with dry pack cement mortar as specified in Section 03 30 00.
2. Forms:
   a. Remove only after concrete has thoroughly hardened. Vertical forms may be removed 24 hours after pour where structure is supported on shores. Remove other forms no sooner than 7 days.
3. Shoring:
   a. Remove shoring only on approval of Structural Engineer but not before concrete has attained the full specified 28-day compressive strength.
   b. Shoring for beams and slabs shall remain in place at all ties until all concrete work over has been completed; if necessary to remove any shoring in order to remove plywood forms, shoring so removed shall immediately be reinstalled to support all loads.
4. Finished Surfaces:
   a. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged, and that corners are true, sharp, and unbroken.
   b. Release sleeve nuts or clamps, and pull the form ties neatly.
   c. Do not permit steel spreaders, form ties, or other metal to project from, or be visible on, any concrete surface except where so shown on Drawings.

3.3 FIELD QUALITY CONTROL

A. INSPECTIONS

1. Testing will be performed as required by International Building Code, as adopted by local jurisdiction, and these Specifications.
2. Inspections of formwork shall include configuration, form, and steel cleanliness.
3. Inspect erected formwork for conformance with approved drawings, for design and seal of form joints, and for type and location of form ties.

END OF SECTION 03 10 00

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Drawings and general provisions of the Contract Documents including General, Supplemental and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. Related work:

1. Section 03 10 00: Concrete formwork.
2. Section 03 30 00: Cast-in-place concrete.
3. Section 04 22 00: Concrete Unit Masonry.

1.2 QUALITY ASSURANCE

A. Comply with the pertinent provisions of the latest edition of the following, except as may be modified herein.

1. ACI 318 “Building Code Requirements for Reinforced Concrete”, hereinafter called “ACI 318”.
2. ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”, hereinafter called “ACI 315”.
3. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

B. Inspections: Drawings and general provisions of the Contract Documents including General, Supplemental and other Conditions and Division 1.

C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.

1.3 SUBMITTALS

A. SHOP DRAWINGS

1. The Contractor shall submit to the Architect, for review, complete and reviewed, reinforcing steel bending and placing diagrams prepared by or under the supervision of a qualified steel detailer; prepare in accordance with ACI 315.
2. Shop drawings shall show details, dimensions and schedules for the fabrication and placing of reinforcing and accessories. Fabrication of items shown in shop drawings shall not begin until Architect has completed his review.
3. Include materials list of items proposed to be provided under this Section, together with manufacturer’s specifications and other data needed to prove compliance with specified requirements.
4. Shop drawings are interpretations of and are supplemental to the design drawings and specifications. Their intent is to demonstrate to the Architect that this Contractor has understood the design concept, and to provide the detailed information necessary for the fabrication, assembly and installation of the products or materials specified. Neither the

shop drawings nor comments placed on them by the Architect shall be construed as being change orders.

PART 2 - PRODUCTS

2.1 MATERIALS

A. BAR REINFORCING STEEL

1. Unless otherwise specifically noted in Structural Notes, furnish deformed bars meeting requirements set forth in ASTM A615 minimum, Grade 60. Bars shall be unpainted, uncoated, and free from rust, dirt and loose scale.
2. Where reinforcing requires welded connections, and where specifically required by the drawings, furnish weldable reinforcing bars which meet the chemical requirements of ASTM A706 (Grade 60 ksi) with a minimum carbon equivalent of .55 percent.

B. WELDED STEEL WIRE FABRIC

1. Furnish welded wire fabric meeting requirements set forth in ASTM A185 and A82, Fy=65 ksi.

C. FIBROUS SECONDARY REINFORCEMENT

1. General:
   a. Use in all elevated concrete slabs, all topping slabs placed over plywood or metal decking, and all concrete mixes for interior and exterior slabs on grade and walls.
   b. Acceptable fibrous secondary reinforcement for slabs shall be filamentized nylon or polypropylene fiber which is inert to alkali and chemical attack; fiberglass fibers are not acceptable.
2. Concrete Fibers For All Interior and Exterior Slabs on Grade, Elevated Slabs, Topping Slabs Placed Over Metal Decking, and Walls, unless otherwise specified: Concrete fibers for all designated areas shall be 100% virgin polypropylene material. Fibers shall be ½" or ¾" and shall be Grace "Microfiber" by W.R. Grace, "Fibermesh 150" by Fibermesh Co., or equal. Fibers shall be used at a minimum dosage rate of 1-1/2 lbs. per cubic yard.

D. ACCESSORIES

1. General:
   a. Use wire bar type supports complying with CRSI recommendations, unless otherwise shown on Drawings. Do not use wood, brick, or other non-complying material.
   b. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   c. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized, plastic-protected legs, or stainless steel. In addition, portions of all accessories within ¾" of the concrete surface for painted or unpainted exposed concrete surfaces shall be stainless steel and bars shall be tied with stainless steel wire, whether for exterior or interior exposure.
2. Tie Wire:
   a. 16 gauge or heavier, double annealed wire.
3. Spacer Bars for Wall Reinforcing:
   a. No. 3 bars, "U" shaped. Stock items of equivalent function may be submitted for approval.

4. Mortar Blocks:
   a. Furnish as required for use as spacers in placing reinforcement; shall be 2” square by 3” tall (maximum).
   b. Mortar blocks shall be constructed of mortar mixed with the same proportions of sand and cement used in concrete and develop a minimum compressive strength of 4,000 psi at 28 days.
   c. Mortar blocks shall have a tie wire embedded and the protruding ends to be tied to the reinforcing steel to hold the mortar blocks in place; mortar blocks with a grooved top may be used for supporting steel in slabs.
   d. Do not use wood, brick, or other non-complying material.
5. Metal Chair Supports:
   a. In lieu of mortar blocks, furnish approved heavy-duty plastic-type chair supports, sized to support all slab steel to proper height and with cushioned pads to prevent vapor barrier membrane penetration.
6. Formsaver Splices:
   a. Formsaver splices shall develop 125% of the specified yield strength of the bar being spliced and shall be Dayton Superior D51A, nVent Lenton Formsaver, or equal.
7. Dowel Baskets:
   a. Dowel baskets shall be used to support smooth dowels at all dowel joints. Dowel baskets shall be of welded thick gauge steel wire construction and shall be hot dip galvanized or epoxy coated.
8. Plate Dowels:
   a. Plate dowels shall be Diamond Dowels by PNA Construction Technologies, Taper Dowels by SureBuilt Concrete Forms and Accessories, or equal.

2.2 FABRICATION

A. General:

1. Fabricate reinforcing bars to conform to the required shapes and dimensions, with fabrication tolerances complying with the CRSI Manual and ACI 318.
2. In case of fabricating errors, do not straighten or rebend reinforcement in a manner that will weaken or injure the material.
3. Reinforcement with any of the following defects will not be acceptable.
   a. Bar lengths, depths, and/or bends exceeding the specified fabrication tolerances;
   b. Bends or kinks not shown on the Drawings;
   c. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Hooks & Bends:

1. Minimum Bend Diameter: The diameter of bend measured on the inside of the bar for standard hooks, other than stirrup and tie hooks, not less than:

Bar Size	Minimum Diameter

#3 through #8	6 bar diameters
#9 through #11	8 bar diameters

2. Field bending of reinforcing bars, unless specifically noted on the Plans, will not be allowed. If bars are found to be field bent, especially brittle grade 60 bars, the Contractor will be responsible to provide corrective measures as directed by the Architect.

B. Cleaning Reinforcement:

1. Clean reinforcement, at time concrete is placed, free of mud, oil, or other materials that will reduce the bond. Conform to ACI 318 and IBC Chapter 19.

C. Placing & Fastening Reinforcement:

1. General:
   a. Conform to ACI 318.
   b. Prevent water from softening soil under reinforcing during steel placing.
   c. Conform to ACI 318 for placing, supports, tolerances, and draped fabric, unless noted otherwise on Drawings.
2. Placement:
   a. Place reinforcement as shown on Drawings.
   b. Accurately position in accordance with shop drawings; support and tie intersections in accordance with best practices and as necessary to secure reinforcement and prevent displacement by formwork, construction, or concrete placement operations.
   c. Locate and support reinforcing by metal chairs or mortar blocks as required; wood or foam supports are not acceptable.
   d. Support smooth bars at dowel joints by dowel baskets.
   e. Reinforcing bars may be relocated as necessary to avoid interference with other reinforcement, conduit, or other embedded items.
   f. If any reinforcing bar is moved a distance exceeding one bar diameter of the specified placing tolerance, the resulting rearrangement of the reinforcement shall be subject to acceptance by the Structural Engineer.
   g. Reinforcement to maintain minimum concrete coverage as shown.
3. Fastening:
   a. Securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement.
   b. Set wire so that ends are directed into the concrete.
   c. Wire tie stirrups and ties to main reinforcement.
4. Supports:
   a. General: Provide sufficient number of supports and of strength to carry the reinforcement. Do not place reinforcing bars more than 2 inches beyond last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
   b. On ground: Use concrete block.
   c. Over Formwork: In unexposed areas use concrete block or metal chairs. In exposed slabs and similar conditions use approved “invisible” metal chairs, hot-dip galvanized or approved plastic type.

D. SPACING OF BARS

1. Space reinforcing bars to comply with ACI 318 unless otherwise noted on Drawings. In conformance with placement requirements specified above, reinforcing bars may be relocated as necessary to avoid interference with other reinforcement, conduit, or other embedded items.

E. SPLICES IN REINFORCEMENT

1. CRSI standard by lapping ends, placing bars in contact, and tightly wire tying or by welding in an approved manner, except as noted otherwise. Do not splice bars except at locations shown on Drawings, except as otherwise specifically approved by Structural Engineer.
2. All welding to conform to “Recommended Practice for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete” of the American Welding Society (AWS D 12.1), performed in accordance with AWS D1.4.
3. All reinforcing bars requiring hooks: The minimum “Standard Hook” and leg extension, except as otherwise noted.
4. Splice in a manner developing at least 125% of the yielding strength of the bar.

F. SHRINKAGE & TEMPERATURE REINFORCEMENT

1. Conform to ACI 315 for reinforcement for shrinkage and temperature stresses normal to principal reinforcement where same is placed in one direction only.

G. CONCRETE PROTECTION FOR REINFORCEMENT

1. Conform to Structural Drawings and ACI 318.

H. STEEL DOWELS

1. Provide dowel bars where shown or required for connecting to in-place or subsequent work as shown.

I. PLACING WELDED WIRE FABRIC

1. Install in all concrete slabs on grade and concrete slabs on metal deck, except slabs where bar reinforcing is indicated; provide sizes specified herein or otherwise indicated, and with minimum coverages indicated for concrete protection.
2. Install welded wire fabric in as long of lengths as practical.
3. Lap adjoining pieces at least 12” or one full mesh spacing plus 2”, whichever is greater, and lace splices with 16 gauge wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
4. Do not carry through smooth-doweled expansion joints.
5. Provide chairs to support the welded wire fabric and reposition the welded wire fabric as required to maintain it at the proper position during concrete placement.

J. FIBROUS SECONDARY REINFORCEMENT

1. For all slabs on grade, elevated slabs, topping slabs, and walls as specified above, add fibrous reinforcing to concrete mix at the batch plant, at manufacturer’s recommended rate per cubic yard of standard weight and lightweight concrete mixes, and in strict accordance with fiber manufacturer’s printed instructions.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. WORK INCLUDED: Drawings and general provisions of the Contract Documents including General, Supplementary and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. RELATED WORK

1. Section 03 10 00: Concrete Formwork.
2. Section 03 20 00: Concrete Reinforcement.
3. Section 03 34 50: Concrete Finishing.
4. Section 09 35 43: Polished Concrete Finishing.
5. Section 07 92 00: Joint Sealants.

C. COORDINATION

1. Coordinate all installation under this Section with work of other trades.

D. Pre-Installation Meeting

1. Approximately two to four weeks prior to scheduled commencement of concrete installation and associated work, meet at project site with concrete subcontractor, associated finish, concrete polishing subcontractor, flooring, and coating Installer(s), Architect, Owner, Special Inspector, Structural Engineer, and other representatives directly concerned with performance of the work including (as applicable) test agencies and governing authorities.
2. Review foreseeable methods and procedures related to concrete work, including, but not necessarily limited to, the following:
   a. Inspect and discuss condition of substrates, penetrations and other preparatory work performed by other trades.
   b. Review concrete requirements (drawings, specifications, and other Contract Documents).
   c. Review required submittals, both completed and yet to be completed.
   d. Review and finalize construction schedule related to concrete work and verify availability of materials, Installer’s personnel, equipment and facilities needed to make progress and avoid delays.
   e. Review required inspection, certifying and material usage accounting procedures.
   f. Review weather and forecasted weather conditions as they may apply, and procedures for coping with unfavorable conditions, including requirements for temporary protection.
   g. Review special exposed concrete finishes and all associated items including special concrete mixes, materials, placing, curing, jointing, finishing, and protection requirements.
   h. Review methods of placing and finishing concrete slabs to achieve floor flatness and levelness requirements.
   i. Review the method of placing screed pins for elevated concrete slabs on metal deck to achieve floor flatness requirements.
   j. Review Special Inspection requirements for concrete materials.
   k. Review Special Inspection requirements for concrete slab finishing.

1.2 QUALITY ASSURANCE

A. GENERAL

1. Concrete shall conform to all minimum provisions of the latest edition of the (ASTM) American Society for Testing and Materials and the (ACI) American Concrete Institute noted within this specification, except as modified by the Supplemental Requirements contained herein.
2. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
3. Preinstallation (or Preconstruction) Conference: Conduct conference at Project site to comply with requirements in Division 1 Section “Contractor Project Management and Coordination”.

B. STANDARD SPECIFICATIONS

1. Conform to ACI 301 “Specifications for Structural Concrete for Buildings.”
2. Conform to ACI 302 “Guide for Concrete Floor and Slab Construction”.
3. Conform to ACI 304 “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”.
4. Conform to ACI 306R “Recommended Practice for Cold Weather Concreting”; conform to ACI 305R “Recommended Practice for Hot Weather Concreting”.
5. Conform to ACI 308 “Standard Practice for Curing Concrete”.
6. Conform to ACI 318 “Building Code Requirements for Reinforced Concrete”.
7. Unless otherwise shown or specified, design, construct, erect, maintain, and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute Standard ACI 347, “Recommended Practice for Concrete Formwork”.

C. QUALITY CONTROL

1. Do not commence placement of concrete until mix designs have been reviewed and approved by the Architect and all governmental agencies having jurisdiction, and until copies are at the job site and the batch plant. Also, no concrete shall be placed until the Contractor has secured the Special Inspector’s and Architect's approval of the completed reinforcement placement.
2. See drawings and general provisions of the Contract Documents including General, Supplementary, and other Conditions and Division 1. Also see other requirements for testing and inspection as stated in Part 3 of this Section; conform to requirements, therefore, and furnish materials for tests. Give Inspector full cooperation.

D. NOTICE OF INTENTION TO PLACE CONCRETE

1. Notify Architect, Structural Engineer, and Special Inspector at least 48 hours prior to an intended pour.

1.3 SUBMITTALS

A. SUBMIT

1. Submit list of all items proposed to be provided under this Section together with manufacturer’s product data and installation instructions for all such proprietary materials.

B. Provide the following submittals in accordance with ACI-301:

1. Admixture certification. Chloride ion content must be included.
2. Aggregate certification.
3. Concrete mix design. Submit a mix design for each strength, and type of concrete. Clearly indicate where each mix design will be used.
4. Construction and control joints.
5. Materials and methods for curing (per Section 033450).
6. Laboratory tests on concrete.
7. Plans showing local test sections for flatness and levelness (per Section 033450).

1.4 JOB CONDITIONS

A. WINTER CONCRETING

1. Provide adequate equipment for heating materials and protecting concrete during freezing or near-freezing weather.
2. Keep all materials, reinforcement, forms, and ground in contact with concrete, free from frost; use no materials containing ice.

B. HOT WEATHER CONCRETING

1. Employ measures to reduce concrete temperature and water evaporation by proper attention to ingredients, production methods, handling, placing, protecting, and curing.

C. LOADING STRUCTURES

1. Protect all in-place structures from excessive loading. Shore and brace as necessary to prevent all damage.

D. FIELD REFERENCE MANUAL

1. A copy of ACI SP-15 “Field Reference Manual” which includes ACI 301 shall be kept in the Contractor’s Field Office at all times.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Provide in accordance with Section 031000 for all work of this Section.

2.2 CONCRETE MATERIALS

A. PORTLAND CEMENT

1. Provide a standard brand of Portland cement complying with ASTM C150, Type II, low alkali. Do not change the brand of cement during progress of the Work except as approved in writing by the Architect.

B. AGGREGATE

1. General

a. Provide hardrock aggregate complying with ASTM C33, with additional attributes specified herein.
b. For making grading tests of fine and coarse aggregate, use square mesh wire cloth complying with ASTM E11.
c. Aesthetic properties of aggregates which will be exposed at ground and polished slabs shall conform to the requirements of the Architect.

2. Fine aggregate
   a. Provide washed natural sand having strong, hard, durable particles, and containing not more than 2% by weight of deleterious matter such as clay lumps, mica, shale, or schist.
   b. Grade from coarse to fine within the following limits:

Sieve size:	Percentage by weight passing sieve: Minimum:	Maximum:
3/8"	100	---
No. 4	95	100
No. 8	80	100
No. 16	50	85
No. 30	25	60
No. 50	10	30
No. 100	2	10

3. Coarse aggregate
   a. Provide coarse aggregate consisting of clean, hard, fine grained, sound crushed rock or washed gravel, or a combination of both, containing not more than 5% by weight of flat, chip-like, thin, elongated, friable, or laminated pieces, nor more than 2% by weight of shale or cherty material. Any piece having a length in excess of five times the average thickness shall be considered flat or elongated.
   b. Use coarse aggregate of the largest practicable size for each condition of placement, subject to the following maximum size limitations: Do not exceed 3/4 of the clear distance between reinforcing bars 1/5 of the narrowest dimension between sides of forms, or 1/3 the depth of any slab section.
   c. Grade from course to fine within the following limits for the aggregate sizes shown:

Sieve size or size in inches:	Percentage by weight passing sieve: 1-1/2" (#4) aggregate: Min:	Max:	3/4" (#67) aggregate: Min:	Max:
2"	100	---	---	---
1-1/2"	90	100	---	---
1"	20	55	100	---
3/4"	0	15	90	100
1/2"	---	---	---	---
3/8"	0	5	20	55
No. 4	---	---	0	10
No. 8	---	---	0	5
No. 16	---	---	---	---

4. Combined gradation
   a. Mix designs shall make the best use of locally available materials to provide a uniform aggregate gradation. The Contractor shall submit mix designs that are suitable for the intended use, minimize shrinkage and have a proven history of superior performance.

C. WATER

1. Use only water which is clean and free from deleterious amounts of acid, alkali, salt, and organic materials.

2.3 ADMIXTURES

A. Use only standard brands of admixtures for concrete, approved by the Architect, meeting or exceeding the following requirements.

1. Air entraining admixtures shall conform to "Specifications for air-entraining admixtures for Concrete" ASTM C-260.
2. Water Reducing Admixture: "Eucon WR-75" by The Euclid Chemical Co., "Pozzolith 200N" by Master Builders, "Plastocrete 161" by Sika Corporation, WRDA-64 by W.R. Grace, or equal. The admixture shall conform to ASTM C-494, Type A and not contain more chloride ions than are present in municipal drinking water.
3. Water Reducing, Retarding Admixture: "Eucon Retarder-75" by The Euclid Chemical Co., "Pozzolith 100XR" by Master Builders, DARATARD-17 by W.R. Grace, "Plastocrete 161MR" by Sika Corporation, or equal. The admixture shall conform to ASTM C-494, Type D and not contain more chloride ions than are present in municipal drinking water.
4. Mid-Range Water Reducing Admixture: "Daracem-55" as manufactured by W.R. Grace, "Sikament HP" as manufactured by Sika Corporation, or equal. The admixture shall not contain calcium chloride, and shall conform to ASTM C-494, Type A.
5. High Range Water Reducing/Retarding Admixture (Superplasticizer): "ECON 537" by The Euclid Chemical Co., DARACEM 100 by W.R. Grace, "Sikament 320" by Sika Corporation, or equal. Admixture shall conform to ASTM C-494, Type G, and not contain more chloride ions than are present in municipal drinking water.
6. High Range Water Reducing Admixture (Superplasticizer): "Eucon 37" by The Euclid Chemical Co., WRDA-19 by W.R. Grace, "Sikament 86" by Sika Corporation, or equal. The admixture shall conform to ASTM C-494, Type F, and not contain more chloride ions than are present in municipal drinking water.
7. Non-Corrosive, Non-Chloride Accelerator: "Accelguard 80" by The Euclid Chemical Co., DARASET by W.R. Grace, "Plastocrete 161FL" by Sika Corporation, or equal. The admixture shall conform to ASTM C-494, Type C or E, and not contain more chloride ions than are present in municipal drinking water.
8. Concrete Corrosion Inhibitor: DCI Corrosion Inhibitor by W.R. Grace & Co., "Armatec 2000" by Sika Corporation or equal. The admixture shall conform to ASTM C-494 Type C. When this is specifically noted to be used, it shall be used at the dosage rate recommended by the manufacturer.
9. Shrinkage Reducing Admixture: Shall conform to ASTM C494 Type S, shall be used at the rate recommended by the manufacturer, and shall be “Eclipse Floor 200” by GCP Applied Technologies, “Eucon SRA Floor” by Euclid Chemical Company, or equal. Use at all architecturally exposed interior slabs on grade and at all concrete on metal deck.
10. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05% ions by weight of cement are not permitted.
11. Certification: Written conformance to the above mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Architect.

2.4 ACCESSORY MATERIALS

A. Expansion joint filler: Where shown to be used, provide preformed strips, non-extruding and resilient bituminous type, of thickness indicated, complying with ASTM D1751, ("Fibre Expansion Joint" by W.R. Meadows, Sika Joint Filler, or equal).

B. Curing and Sealing Compound: (Meeting ASTM C-309) The compound shall be a clear styrene acrylate type, 30% solids content minimum, and have test data from an independent testing

laboratory indicating a maximum loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon. Compound shall be "Super Rez Seal" by The Euclid Chemical Co., "Vulkem 2101" by Mameco International, Inc., "Masterkure 30" by Master Builders, "Sealtight CS-309" by W.R. Meadows, or equal. Manufacturer's Certification required. (Sodium Silicate Compounds are prohibited.) To be used where exterior concrete slabs are to be left exposed and where no special Architectural finish is specified.

C. Dissipating Resin Curing Compound: (Meeting ASTM C-309) The compound shall be a dissipating resin type compound, "Kurez DR" by The Euclid Chemical Co., "Vulkem 2100" by Mameco International, "Sealtight 3100" by W.R. Meadows, or equal. The film must chemically break down in a two-to-four week period. (To be used where a dissipating curing compound is required.) All curing compounds shall be certified to ensure that no conflict exists with any required floor covering adhesives.

D. Curing and Sealing Compound for Interior Slabs: The compound shall be VC-5 curing compound manufactured by SINAK, Euclid Ultrasil DC9, Ashford Formula, or equal. This compound shall be used at all interior Slab-on-Grade floors.

E. Bonding Materials: The compound shall be a polyvinyl acetate, rewettable type, "Euco Weld" by The Euclid Chemical Company, "Weld-crete" by The Larsen Company, or equal. Use only in areas not subject to moisture.

F. Bonding Admixture: The compound shall be a latex, non-wettable type, "SBR Latex" or "Flex-Con" by The Euclid Chemical Company, "Daraweld C" by W.R. Grace, or equal.

G. Structural Bonding Epoxy Adhesive: The compound shall meet ASTM C-881 and shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces, "Euco Epoxy #452 MV or #620" by The Euclid Chemical Company, "Sikadur Hi-Mod", "Sikadur 32 Hi-Mod LPL" by Sika Chemical Corporation, or equal.

H. Patching Mortar: "Verticoat" by The Euclid Chemical Co., "Sika Repair 223" by Sika Chemical Corporation, or equal. The compound shall be epoxy type, 100% solids, suitable for use on dry or damp surfaces.

I. Patching Compound: Free-flowing, polymer-modified cementitious repair mortar, "Euco Thin Top Supreme" by The Euclid Chemical Co., "SikaTop 121", "SikaTop 122" by Sika Corporation, or equal.

J. Interior Slab Epoxy Joint Filler: Shall be a multi component, 100% solids compound with a minimum shore D hardness of 50, "Euco Epoxy #700" by The Euclid Chemical Company, "Sikadur 51 NS/SL" by Sika Chemical Corporation, or equal. When and where this is specifically noted to be used, this shall be applied as late as possible after the concrete floor slab is poured, preferably at least 6 months, but not earlier than 2 months after the concrete floor slab is poured. Use only in locations specified.

K. Polished Slab Joint Filler: Joint filler at expansion joints in polished slabs shall be per Section 03 35 43 of these Specifications.

L. Non-shrink Grout: The grout shall conform to CRD C-621-83, "Corps of Engineers Specification for Non-shrink Grout". The grout shall be "Euco N-S" (non-metallic) by the Euclid Chemical Company, "Masterflow 713" (non-metallic) by Master Builders, "Sealtight 588 Grout" by W.R. Meadows, or equal.

M. Abrasive Aggregate for Non-slip Aggregate Finish: "Non-Slip" by The Euclid Chemical Company, "Alundum" by North Company, or equal.

N. Evaporation Retarder: The compound shall be "SikaFilm" by Sika Corporation, "Confilm" by Master Builders, “Eucobar” by Euclid Chemical Company, or equal.

O. Fiber Reinforcing: Fiber reinforcing for all designated areas shall be 100% virgin polypropylene material. Fibers shall be 1/2" or 3/4" in length: Grace "Microfiber" by W.R. Grace, "Fibermesh 150" by Fibermesh Co., Buckeye Ultra Fiber 500, or equal. Fibers shall be used at a minimum dosage rate of 1-1/2 lbs. per cubic yard.

P. V.O.C. Curing and Sealing Compounds: When curing and sealing compounds must meet V.O.C. regulations (or under such conditions where proper ventilation for safety is not possible), the curing and sealing compounds shall meet ASTM C-309 and shall be "Sealtight Vocomp 25" water-base acrylic cure and sealing compound by W.R. Meadows, Euclid Super Diamond Clear VOX, or equal. All curing and sealing compounds shall be coordinated with any floor coverings to insure that no conflict exists with the required adhesives.

Q. Chemical Floor Hardener: Liqui-hard by W.R. Meadows, Euco Diamond Hard by Euclid Chemical, or equal.

R. Waterstops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50° F to plus 175° F working temperature range, 4” wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; Greenstreak, J.P. Specialties Earth Shield, or equal. All waterstops shall comply with the Corps of Engineers CRD-C 572.

S. Self-Leveling Compound: Shall be Sika Level-325, Mapei Ultraplan M20 Plus, or equal.

2.5 EQUIPMENT FOR MIXING & PLACING

A. CONVEYING EQUIPMENT

1. Use crane bucket, wheelbarrow, pumps, or buggies to deliver concrete to placing location.
2. Chuting permitted only by methods to insure a practically continuous flow of concrete at delivery and to prevent material separation.
3. If pumping is employed, secure prior approval of equipment, procedures and mix design. No aluminum pipes or chutes will be permitted for pumping, chuting or tremie operations.

B. COMPACTION EQUIPMENT

1. Use internal mechanical vibrators with 7000 rpm minimum frequency.

2.6 CONCRETE MIXES

A. Provide a mix design prepared by the approved testing agency, based on strengths of the approved materials, and meeting the requirements stated on the Drawings.

B. Proportions for concrete mixes shall be in accordance with ACI 301. All mixes must be approved by the Architect prior to use on the job. No deviations from the approved mixes will be permitted without written prior approval of the Architect.

C. Where the concrete production facility can establish the uniformity of its production for concrete of similar strength and materials based on recent test data, the average strength used as a basis for determining mix design proportions shall exceed the specified design strength by the requirements of ACI-318 or ACI-301.

D. When a concrete production facility does not have field test records for calculation of standard deviation, the required average strength shall be at least 1200 psi greater than the specified design strength.

E. Secure the Architect's approval of each mix design, including new mix designs required to be prepared should there occur a change in materials being used.

F. All concrete shall contain the specified water-reducing or water-reducing retarding admixture (superplasticizer). All concrete slabs, placed at air temperatures below 40° F shall contain the specified non-corrosive non-chloride accelerator. All concrete required to be air entrained shall contain an approved air-entraining admixture. All pumped concrete, concrete for industrial slabs, architectural concrete, concrete required to be watertight, and concrete with a water-cement ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer). All concrete slabs and flatwork, both interior and exterior, shall contain the specified fiber reinforcing. All concrete on metal deck and concrete at architecturally exposed interior slabs on grade shall contain shrinkage reducing admixture.

G. Prior to the jobsite addition of water-reducing admixture, concrete shall have a maximum slump of 3" for slabs and 4" for other members. This maximum slump may not be exceeded except by the job-site addition of the specified water-reducing admixture. The concrete shall arrive at the job site at the maximum slump indicated, be verified, then the water-reducing admixture added to increase the slump to the approved level. Concrete on metal deck containing water reducing admixture shall have a maximum slump of 6”. All other concrete containing water-reducing admixture shall have a maximum slump of 8" unless otherwise approved by the Architect. In those portions of the structure where member dimensions and/or congestion due to reinforcing steel prevent the proper placement and consolidation of the concrete at the maximum slump specified, water-reducing admixture shall be used by the Contractor in lieu of increasing the slump of the concrete by the addition of water.

I. Do not re-temper mix by adding water in the field.

J. Hardrock concrete

1. Achieve a unit weight of 130 pcf to 145 pcf and conform to the properties listed in the following table.

Location	Req’d. 28 day Compressive Strength	Maximum Water Cement Ratio	Air Content
Footings, grade beams, mat foundations, walls and all other concrete below grade	3000	0.50	3% Max. (entrapped)

Interior slabs on grade, and Interior walls	4000	0.45	3% Max. (entrapped)
Exterior concrete subjected to freezing and thawing and deicers including site walls and flatwork.	4500	0.45	5% - 7% (entrained)

K. Air Content at Interior Trowel-Finished Floors

1. The air content of interior trowel-finished floors shall not exceed 3%.

PART 3 - EXECUTION

3.1 PREPARATION

A. SURFACE CONDITIONS

1. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. CLEANING FORMS

1. Before placing concrete, clean spaces within forms of all refuse, debris and dirt. Provide cleaning holes for removal of foreign matter; after cleaning, replace forms at openings and brace to prevent form failure.

C. MIXING & PLACING

1. Conform to the requirements of ACI 301.
2. Clean free of all foreign matter and ice, all mixing and transporting equipment, subgrade and forms to receive concrete.
3. Clean reinforcement of deleterious coatings and ice.

D. EMBEDMENT FOR GENERAL WORK IN OTHER SECTIONS

1. Allow other trades time and facilities to install necessary embedded items such as nailers, hangers, inserts and sleeves; and other items as noted herein.

E. EMBEDMENT FOR MECHANICAL & ELECTRICAL WORK

1. Pipes and conduits may penetrate slabs within the limitations shown in the structural Drawings but will not be allowed to run in slabs on grade or elevated slabs without written permission from the Architect.
2. Place sleeves and core forms as required for mechanical and electrical work, sizes and locations as shown on the Drawings or as directed by relevant trades.

3.2 INSTALLATION OF FORMWORK

A. In accordance with Section 03 10 00.

3.3 CONCRETE MIXING

A. Concrete for minor work, when approved by the Architect, may be mixed at the site in a power mixer when the mixer has a capacity not less than one full sack batch.

B. Unless otherwise approved by the Architect, use ready mixed concrete complying with ASTM C94.

1. Mixing
    a. Mix each batch of concrete not less than 15 minutes, five minutes of which shall be at the site.
    b. Rotate the drum at the rate specified by the manufacturer of the mixer as "mixing speed."
    c. Whenever there is a delay in unloading, rotate the drum slowly at intervals to prevent incipient set of concrete.
2. Addition of water:
    a. Normally, do not deliver concrete with total permissible amount of water incorporated therein.
    b. After water is added, at least five minutes of mixing time shall be immediately prior to discharge.
    c. Concrete will be rejected if not placed in final position within 1-1/2 hours after water is first added to the batch.
3. Concrete at time of placing shall be in such condition that it can be placed properly.
4. Discharge all wash water from the mixing drum before the truck reloads at the batching plant.
5. Mixing equipment shall not be charged beyond its rated capacity.

C. Concrete consistency

1. Use the amount of water established by the approved mix design.
    a. Do not exceed the maximum quantity specified for the grade of concrete.
    b. Use the minimum amount of water necessary to produce concrete of the workability required by the Architect.
    c. Do not supplement the predetermined amount of water with additional water for any reason.
2. Measure concrete consistency by ASTM C143 method.
3. Prior to the on-site addition of water-reducing admixture, provide maximum slumps of concrete as follows:
    a. Footings and slabs on soil: 3", (+1", -1").
    b. Other concrete: 4".

D. Cement grout and dry-pack grout

1. Mix at the site, in composition of one volume of portland cement to 2-1/2 volumes of fine aggregate.
2. Mix the materials dry; then add sufficient water to make the mixture flow under its own weight.
3. When grout is used as dry-pack concrete, add sufficient water to make a stiff mixture which can be molded into a sphere.

E. Miscellaneous provisions

1. Provide strengths of concrete as shown on the Drawings and the table herein.

2. Provide concrete dense and free from honeycomb and other defects.
3. Place and finish members to conform to the shapes and dimensions indicated, with all surfaces true to line, plumb, and level.

3.4 INSERTS, ANCHORS, AND EMBEDDED ITEMS

A. Concrete fasteners

1. Where hanger rods, bolts, wire, or similar items are used to suspend construction items, place in the concrete as required and/or indicated.

B. Reglets, Reveals, and Rebates

1. Form reglets, reveals and rebates as required to receive frames, flashing, and other equipment, and as shown on the Drawings.
2. Verify the dimensions and positions of required reglets, reveals, and rebates with the Architect and with trades whose work is related to or contingent upon such dimensions and positions.

C. Embedded Piping, and Rough Hardware

1. Coordinate the various trades who are required to fasten work to the structure, or are required to insert therein any sleeve, box, bolt, anchor, insert, or other rough hardware.
2. Provide every facility for setting all required items accurately in the forms.
3. Be responsible for changes in position of such items after they have been set.
4. Provide in the forms for all sleeves, boxes, bolts, anchors, inserts, strap anchors, for frames, and other rough hardware required for the Work, and which are shown or required to be embedded in the concrete.
5. Conduits and sleeves
   a. Do not place pipes or conduits in slabs on grade or elevated slabs.
   b. Conduits or pipes shall run below elevated slabs or they shall be located in trenches below slabs on grade.

3.5 CONVEYING AND PLACING CONCRETE

A. Before placing concrete, thoroughly clean forms, wash out with water, and make tight.

B. Time of placing

1. Do not place concrete until reinforcement, conduits, outlet boxes, anchors, sleeves, hangers, bolts, and other embedded materials are securely and properly fastened in their correct positions.
2. Secure the Architect's approval of reinforcement before commencing placement of concrete.

C. Preparation

1. Before new concrete is deposited upon or against concrete that has taken its initial set or has hardened, remove all incrustations from forms and reinforcement.
2. Remove all laitance, oil, and loose particles from concrete and concrete surfaces, and thoroughly clean the forms with water under stiff pressure.
3. Remove all laitance after concrete has hardened partially (not less than two hours nor more than four hours after placing) by brushing with stiff bristles, or by directing a stream of water

from a 1/4" nozzle, or by other methods approved by the Architect, to expose the clean top surface of the coarse aggregate.

4. Where cleaning is not satisfactory to the Architect, sandblast the surface and then wash again.

D. Method of placing

1. Place concrete only under the degree of inspection described elsewhere in these Specifications, and as required by governmental agencies having jurisdiction.
2. Do not place concrete outside of regular working hours unless required inspection authorities have been notified properly and are present.
3. Spouts, pipes, troughs, belts, chain buckets, and other equipment may be used in conveying concrete, but the manner and method used shall be only as approved by the Architect.
4. Do not permit concrete to free drop more than 4'-0".
5. Deposit concrete direct into conveyances, and direct from conveyances to final points of repose, except where troughs, buckets, or the like are used, in which case dump concrete into hoppers and then into the conveyances.
6. Where tremies are used, or where the free drop is 4'-0" or more, and through reinforcement, use a dumping box or board, moving the concrete from there by shovels or hoes.
7. Deposit concrete so that the surface is kept level throughout, a minimum being permitted to flow from one position to another, and place as rapidly as practicable after mixing.
8. Do not use in this Work any concrete not placed within 30 minutes after leaving the mixer.

E. Tamping and conveying

1. Thoroughly work concrete around reinforcement and embedded fixtures, and into corners of forms, during placing operations.
2. Completely compact and vibrate all concrete including floor slabs with mechanical vibrators and by tapping forms until the concrete is thoroughly compact and without voids. Determine the number of tampers and vibrators needed by the amount and method of placing concrete.
3. Exercise care to tamp and vibrate concrete vigorously and thoroughly to obtain maximum density.
4. Use manual tampers as well as mechanical vibrators.
5. Exercise care to direct the quick handling of vibrators from one position to another.
6. Do not over-vibrate concrete.
7. Do not move concrete by use of vibrator.
8. Have at least one spare vibrator on site during all concrete pours.

F. Stoppages

1. Stop concrete placing only when and where approved by the Architect.
2. Maintain flow surfaces of freshly placed concrete as level whenever a pour is stopped, providing tight dams to accomplish this.
3. Make horizontal construction joints only where shown on the Drawings or specifically approved by the Architect.
4. Provide keys and dowels at construction joints where indicated on the Drawings, and where concrete placement is interrupted.

3.6 STEPS, SLABS, WALK, AND PAVING ON EARTH

A. Preparation for slabs on earth

1. Prepare the subgrade and base as specified in other Sections.
2. Dampen the subgrade for exterior slabs and paving if necessary prior to placing concrete.

B. Placing and finishing

1. Mechanically vibrate and then tamp the freshly placed concrete until at least 3/8" of mortar is brought to the surface.
2. Screed until depressions and irregularities are worked out and the surfaces are true to specified elevations, flatness, and levelness.
3. Remove excess water and debris worked to the surface in compaction and screeding.
4. Remove laitance as described previously.
5. When concrete has hardened sufficiently, float to a compact and smooth surface.

C. In Slabs-On-Grade Provide

1. Contraction (control) joints in interior work.
    a. By use of tooled control joints or at Contractor's option by sawcutting to 1/4 slab depth.
    b. Where not otherwise shown on Drawings, provide control joints at column centerlines and/or at the following maximum spacing:
        4" slab max. spacing = 10 ft. each way.
        5" slab max. spacing = 10 ft. each way.
        6" slab max. spacing = 12 ft. each way.
        7" slab max. spacing = 14 ft. each way.
        8" slab max. spacing = 14 ft. each way.
    c. Provide close coordination with the Architectural joint layout, pattern and spacing for all exposed to view floor slabs. This layout shall be verified prior to pouring concrete.
2. Joints in Exterior Work
    a. Provide contraction joints in exterior work where shown by means of 1" deep tooled joints with edges rounded and tool marks removed. If the layout of the contraction joints is not shown on the plans, then the Contractor shall submit a proposed layout to the Architect for approval with joints at a maximum of 5’-0” o.c.
3. At all construction joints of slabs on grade (doweled joints), discontinue slab reinforcement, and provide smooth, greased dowels supported on dowel baskets per the provisions of Section 032000 of these Specifications.
4. Where shown to be used, provide isolation joints between slabs and vertical surfaces. Form with 15# felt paper for interior work and expansion joint filler for exterior work.
5. Except at polished slabs, seal all expansion and contraction joints with the here-in specified joint sealing compound.
6. Seal expansion joints at polished slabs with the joint sealing compound specified in Section 03 35 43 of these Specifications.
7. Provide the finish surfaces shown on the Drawings or otherwise directed by the Architect, in accordance with pertinent provisions of Section 033450 of these Specifications.

D. Curing
1. Cure and protect concrete in accordance with pertinent provisions of Section 033450 of these Specifications, and ACI 302.

2. Seal expansion joints at polished slabs with the joint sealing compound specified in Section 03 35 43 of these Specifications.

3.7 SODA AND ACID WASH

A. At concrete surfaces to receive plaster, paint, or other finish, and which have been formed by oil-coated forms, scrub with a solution of 1-1/2 lbs caustic soda to one gal. of water.

B. On surfaces where smooth wood or waste molds have been used, scrub with a solution of 20% muriatic acid or hydro-chloric acid.

C. After the surfaces have been scrubbed, wash with clean water as soon as possible.

3.8 DEFECTIVE CONCRETE

A. The following concrete will be deemed to be defective, and shall be removed promptly from the job site.

1. Concrete which is not formed as indicated, is not true to intended alignment, is not plumb or level where so intended, is not true to intended grades and levels.
2. Has voids or honeycombs that have been cut, resurfaced, or filled, unless with the approval of the Architect.
3. Has sawdust, shavings, wood, or embedded debris.
4. Has cracking which is more than minor hairline cracks, and which are unacceptable to the Architect.
5. Has curled slab edges which are functionally or architecturally unacceptable to the Architect.
6. Does not meet the specified floor flatness and levelness listed in Specification Section 033450.
7. Or does not conform fully to the provisions of the Contract Documents.

B. Repairs and Replacements

1. When required by the Architect, defective concrete shall be cut out to the extent directed by, and replaced using material and methods as approved by, the Architect.
2. Where defective concrete is found after removal of the forms, cut out the defective concrete, if necessary, and make the surfaces match adjacent surfaces.
3. Repair of Surface Defects. All voids, damaged places, fins, projections, honeycomb areas, and tierod holes shall be removed down to sound concrete and shall be repaired immediately after form removal and after a concrete curing compound is applied. The specified bonding agent shall be used for all patching and the specified epoxy adhesive and/or epoxy mortar shall be used for all structural repairs. All patching and repairs shall have prior approval of the Architect as to method and procedure. Any concrete which has not been formed as shown on the contract drawings, is out of alignment or level or indicated a defective surface or unsoundness of any nature shall be removed and replaced to the limits required by the Architect unless he grants permission to patch or otherwise correct the defective work. Permission to patch or attempt the correction shall not be construed to be a waive of the Architect's right to require complete removal of defective work.
4. Work uneven surfaces and angles of concrete to a surface matching adjacent concrete surfaces.
5. The cost of removing, replacing, and repairing defective concrete shall be at the Contractor’s expense.

3.9 GROUTING AND CEMENT POINTING

A. All column base plates, equipment bases, and other locations noted on the structural drawings shall be grouted with the specified non-shrink grout. All exposed grout shall be the specified non-metallic type.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Walls and curbs

1. Construct header walls and curbs as shown on the Drawings.
2. Trowel exposed concrete surfaces smooth.

B. Leave openings in the floor slabs and future foundations for machines and equipment, where so indicated on the Drawings, and in dimensions and arrangements required for the approved machines and equipment.

3.11 INSPECTIONS & TESTING

A. The required testing services of Section 16.3 and 16.4 of ACI-301 shall be performed by an independent testing laboratory approved by the Architect and paid for by the Owner. The testing services required in Section 16.5 shall be performed by the same testing laboratory and paid for by the General Contractor.

B. The testing laboratory representative shall be present during the placement of all concrete unless this requirement is waived by the Architect. The testing laboratory shall conduct the tests specified in 16.3 and in addition shall inspect the reinforcing steel placement (including grade of steel) prior to the beginning of placement. The Contractor shall provide ample notice to the testing laboratory and shall make available to the testing laboratory, shop drawings of the reinforcing steel placement bearing the shop drawing review stamp of the Architect.

C. When requested the testing agency shall provide evidence of recent inspection (within the last three years) of its facilities by the Cement and Concrete Reference Laboratory of the National Bureau of Standards. Evidence shall be presented to indicate that deficiencies mentioned in the report of that inspection have been corrected.

D. Standard slump and cylinder samples (3) must be taken after addition of water. The method of measuring water and the person(s) authorized to add water and make samples must be mutually responsible for cost of additional sampling and testing costs related to discharging concrete in conflict with Contract Documents. All concrete requiring a slump change of more than 2", except when the water-reducing admixture is being used, will be rejected.

E. Compression test specimen: ASTM C 31, one set of 3 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required. Test one cylinder at seven days, one at 28 days, and hold the third cylinder until needed.

F. Slump and compressive strength tests: ASTM C 39 one set for each 50 cu. yd. or fraction thereof, of each class of concrete placed in any one day or for each 5000 sq. ft. of surface area placed: one specimen tested at 7 days, one specimen tested at 28 days and one specimen retained in reserve at the laboratory for later testing if required.

G. Determine air content of normal-weight concrete for each strength test. In addition, for all exterior flat-work concrete, determine air content per ASTM C 231 for each 20 cu. yd. placed.

H. When concrete fails to meet the acceptance criteria specified in ACI-301, the Architect may order further testing of concrete in place in accordance with ACI 301. When such tests are ordered, cost of testing shall be paid by the Contractor.

I. The Contractor shall bear all cost of correcting rejected work, including the cost of the Architect's additional services thereby made necessary.

END OF SECTION 033000

SECTION 03 34 50 - CONCRETE FINISHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Drawings and general provisions of the Contract Documents including General, Supplementary and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. Related work:

1. Section 03 30 00: Cast-in-place concrete.
2. Section 03 35 43: Polished Concrete Finishing
3. Section 07 92 00: Joint Sealants

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Except as may be modified herein or otherwise directed by the Architect, comply with ACI 301, "Specifications for Structural Concrete for Buildings."

C. Preinstallation (or Preconstruction) Conference: Conduct conference at Project site to comply with requirements in Division 1 Section “Project Management and Coordination”.

1. Approximately two to four weeks prior to scheduled commencement of concrete installation and associated work, meet at project site with concrete subcontractor, associated finish, flooring, and coating Installer(s), Architect, Owner, Special Inspector, Structural Engineer, and other representatives directly concerned with performance of the work including (as applicable) test agencies and governing authorities.
2. Review foreseeable methods and procedures related to concrete work, including, but not necessarily limited to, the following:
   a. Inspect and discuss condition of substrates, penetrations and other preparatory work performed by other trades.
   b. Review concrete requirements (drawings, specifications, and other Contract Documents).
   c. Review required submittals, both completed and yet to be completed.
   d. Review and finalize construction schedule related to concrete work and verify availability of materials, Installer’s personnel, equipment and facilities needed to make progress and avoid delays.
   e. Review required inspection, certifying and material usage accounting procedures.
   f. Review weather and forecasted weather conditions as they may apply, and procedures for coping with unfavorable conditions, including requirements for temporary protection.
   g. Review special exposed concrete finishes and all associated items including special concrete mixes, materials, placing, curing, jointing, finishing, and protection requirements.

h. Review methods of placing and finishing concrete slabs to achieve floor flatness and levelness requirements.
i. Review the method of placing screed pins for elevated concrete slabs on metal deck to achieve floor flatness requirements.
j. Review Special Inspection requirements for concrete materials.
k. Review Special Inspection requirements for concrete slab finishing.

D. STANDARD SPECIFICATIONS

1. Refer to Section 03 30 00 for same and conform thereto as they apply to concrete curing and finishing work of this Section.

E. DEFECTIVE WORK

1. Contractor shall remove and replace at his own expense all defective work as adjudged by the Architect.

1.3 SUBMITTALS

A. SUBMIT:

1. Submit manufacturer's product data and installation instructions for proprietary materials including curing agents, sealers, hardeners, and the like.
2. Installer Qualifications for Polished Slabs: Data for company, principal personnel, experience, and training specified in Quality Assurance.
   a. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
   b. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress and is currently certified as Craftsman – Level I or higher by CPAA.
3. Test sections for local flatness and levelness measurements: The Contractor shall coordinate with the Special Inspector and submit a layout of proposed test sections for local flatness and levelness to the Architect for review prior to pouring slabs. Test sections to be used for local values shall not be larger than the smallest of the following:
   a. Individual concrete pours.
   b. Areas bounded by CMU/concrete walls
   c. Areas bounded by cold joints.
   d. 40’x40’, or equivalent maximum area, test sections.
   e. Bays bounded by columns.

B. SAMPLES

1. Sample Mock-up Slab
   a. Provide mock-up slab for polished slabs per Section 03 30 00.

1.4 JOB CONDITIONS

A. Refer to Section 03 30 00 for same and conform thereto as they apply to concrete curing and finishing work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete materials: Comply with pertinent provisions of Section 03 30 00, except as may be modified herein.

B. Surface Retardant for Exposed Aggregate Finish: Furnish Sika “Rugasol C”, Anti-Hydro Waterproofing Co. or Master Builders or Protex Ind., Inc., or equal, liquid chemical surface retardant.

C. Curing Compound for Curing Exterior Slabs and Walls:

1. Furnish liquid membrane-forming curing compound conforming to ASTM C309, Type I clear. Compound shall be a clear styrene acrylate type, 30% solids content minimum, and have test data from an independent testing laboratory indicating a maximum loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon.
2. Compound shall be “Super Rez Seal” by The Euclid Chemical Co., “Vulkem 2101” by Mameco International, Inc., “Masterkure 30” by Master Builders, “Sealtight CS-309” by W.R. Meadows, or equal.
3. Manufacturer’s Certification required. (Sodium Silicate Compounds are prohibited.)

D. Curing Compounds, Protection Paper, and Curing Blankets for Curing Interior Slabs

1. For Recessed Slab Surfaces to Receive Tile Setting Bed: Furnish 6 mil clear visqueen or reinforced waterproof kraft paper conforming to ASTM C171, Type I; liquid membrane-forming curing compound shall not be used for curing interior recessed slabs.
2. For Slabs to Receive Floor Coverings, Interior Slabs to be Sealed, and Interior Slabs to be Left Exposed: Curing compound shall be fully compatible with all flooring adhesives and sealers to be used on the Project and guaranteed by the manufacturer, in writing, not to impair bonding sealer or adhesive, as applies. Furnish VC5 curing compound manufactured by SINAK, Euclid Ultrasil DC9, Ashford Formula, or equal. Use on all interior slabs-on-grade and all interior elevated concrete slabs on metal floor deck.

E. Sealer

1. For interior slabs to receive sealed finish furnish acrylic polymer, water-based sealer conforming to ASTM C309, Type I, Class B clear, non-yellowing; W. R. Meadows “VOCOMP-25”, Euclid Super Diamond Clear VOX, or equal. All curing and sealing compounds shall be coordinated with any floor coverings to ensure that no conflict exists with the required adhesives.

F. Structural Concrete Repair Mortar

1. Furnish Mapei Planitop XS with Planicrete AC additive, SikaRepair SHB with Sika Latex R, or equal.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISHING OF FORMED SURFACES AND REPAIR OF SURFACE DEFECTS

A. General:

1. After removal of forms, give the concrete surfaces one or more of the finishes specified below where so indicated on the Drawings, or directed by the Architect.
2. Immediately after form removal, patch all tie holes and repairable defective areas.
3. Revise the finishes as needed to secure the approval of the Architect.

B. Formed Surfaces to be Concealed in the Finished Work:

1. Leave surfaces with the texture imparted by forms, except patch tie holes and defects.
2. Remove fins exceeding 1/4" in height.

C. Formed Surfaces to be Left Exposes in the Finished Work: All exposed concrete not otherwise specified shall be treated as follows:

1. Fin Removal:
   a. Completely remove all surface fins by hand or power grinding with carborundum stone or power grinder to approved smoothness on surfaces to be left exposed.
2. Voids, Gravel Pockets and Similar:
   a. Cut out defective areas 1” deep; vertical edges.
   b. Wet cavities and adjacent area.
   c. Cement mortar to match adjacent areas, use as little water as possible.
   d. Retemper after 1 to 2 hours for shrinkage, as required.
   e. Thoroughly fill voids and finish off, match adjacent surface in exposed work.
   f. Finish with “Sacked Finish” as specified below.
   g. Keep patched and finished areas damp for 7 days.
3. Tie Holes:
   a. Clean and thoroughly dampen; fill solid with patching mortar as specified above for voids and pockets.

D. Sacked Finish

1. General:
   a. Provide sacked finish as specified below on all exposed surfaces of building walls and other dominant exposed surfaces.
2. Sacked Finish:
   a. Pre-dampen concrete while still green and apply matching color slurry of patching material specified above for minor defective areas and apply with burlap or sponge float.
   b. Remove any surplus, then rub with clean burlap; cure in approved manner.
   c. All sacked finish surfaces shall be smooth and uniform in appearance, pinhole free, with all imperfections completely concealed.

E. Wall & Curb Tops, Horizontal Offsets, Other Unformed Surfaces

1. In general, strike smooth after placing concrete, float to continued uniform surface and to texture reasonably consistent with adjacent formed surfaces, as approved.

3.3 FINISHING SLABS

A. Tolerances

1. The Contractor shall use proper equipment, techniques, personnel, quality control procedures, and other means and methods as required to achieve the slab tolerances noted herein. Where required to achieve these tolerances, special placement equipment such as laser screeds shall be used.
2. The cross-sectional thickness of slabs on grade shall be within +3/8” and -1/4” of the thickness designated on the plans. The cross-sectional thickness of elevated slabs shall be the thickness designated on plans as minimum.
3. The final elevation of slabs on grade shall be within ±1/2” of the elevation designated on plans. At elevated slabs the Contractor is required to compensate for steel deflections and the final elevation of elevated slabs shall be within +0” and -1/2” of the elevation designated on plans.
4. Measurements:
   a. All floors shall be measured in accordance with ASTM E1155 "Standard Test Method for Determining Floor Flatness and Levelness Using the "F-Number" System (Inch-Pound Units).” Results of all floor profile tests (including both the local test section values and a tabulation of the overall FF and FL values for all of the random traffic slabs installed on a given day) shall be provided to the Architect within 72 hours after each slab installation.
   b. All floors shall be measured in accordance with ACI 117’s straightedge method for flatness. One sample shall be taken from each 100 ft^2 and samples must be taken parallel, perpendicular, or at a 45º angle to the longest construction joint of the area.
   c. All floor tolerance measurements shall be made within 24 hours after slab installation. Results of all floor profile tests (including both the local test section values, a tabulation of the overall FF and FL values for all of the random traffic slabs installed on a given day, and the straightedge test method results) shall be provided to the Architect within 72 hours after each slab placement.
5. U.N.O. all floor areas (covered and exposed) are designated as random traffic floors and shall be subject to the surface profile tolerances for floor flatness (FF) and floor levelness (FL) given below. Overall Values shall be for each day’s placement.
   a. Slabs on grade: Specified Overall Value = FF 35 / FL 25
      Minimum Local Value = FF 25 / FL 15
6. For the floor flatness straightedge method, the maximum gap between a 10 ft straightedge and the floor surface shall not exceed:
   a. Slabs on grade: 90% of the samples shall not exceed: 1/4”
      100% of the samples shall not exceed: 3/8”
      Variation in 12” shall not exceed: 1/16”
7. Where slab edges curl to an extent that they are either functionally or architecturally unacceptable, the Contractor shall be responsible to provide corrective measures to the approval of the Architect. This requirement shall remain in force throughout the warranty period.
8. Non-conforming work shall require corrective actions where directed by the Architect. Corrective actions shall be as directed by the Architect, to the extents determined by the Architect and may include, but shall not be limited to: the application of a different flooring or finish, the application of a floor leveling/patching compound in low spots, the grinding down of high spots, or the complete removal and replacement of nonconforming concrete. To maintain consistency of the finish appearance, corrective actions may be required beyond the immediate area of non-conforming work to include as much as the entirety of all exposed slabs on a project.
9. Corrective measures for non-conforming work shall be at the Contractor’s cost.

B. Slab Finishes

1. Unless otherwise shown, scheduled or specified hereinafter, use the following finishes, as applicable:
   a. Furnish smooth troweled finish for all floors to receive resilient floor coverings and carpeting.
   b. Furnish smooth troweled finish for all interior floors to remain as walking surfaces.
   c. Furnish smooth troweled finish for all exterior equipment pads, dumpster pads, and the like.
   d. Furnish broomed float finish for interior recessed slabs to receive ceramic floor tile finishes and associated setting beds.
   e. Furnish exposed aggregate finish of portions of exterior walks as indicated on Architectural and Landscape Drawings.
   f. Furnish broomed trowel finish for all exterior walks, ramps, stairs and miscellaneous slab surfaces not otherwise specified to receive smooth trowel or exposed aggregate finishes.
   g. Furnish “tactile” diamond pattern finish, in addition to broom finish, at handicap ramp cur-cut slab areas indicated to receive “tactile warning surface”.
   h. Furnish “non-slip” finish for cast-in-place curbs and associated gutters, as applicable, integral with sidewalks.
2. Before finishing work begins, place, strike off, consolidate and level and/or slope, as applicable, concrete to condition ready for finishing.
3. Consolidate placed concrete preferably with power driven floats of impact type except for thin joist slabs; use wood or cork-faced hand floats for surfaces inaccessible to power floats.
4. At slab-on-grade floor areas scheduled to receive tile flooring and associated mortar setting bed, recess slabs 2”; slope recessed slabs in these areas to allow for uniform thickness of tile setting bed material.
5. Replace slabs with excessive shrinkage cracks and those not properly sloped and finished to floor flatness and leveling tolerances specified above, as approved, without additional cost to Owner.

C. Float Finish:

1. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further until ready for floating.
2. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
3. During or after the first floating, check the planeness of the surface with a ten foot straightedge applied at not less than two different angles.
4. Cut down high spots and fill low spots.
5. Refloat the slab immediately to a uniform sandy texture.

D. Broomed Float Finish:

1. Provide a floated finish as described above. After floating, draw a broom across surface to a light scored texture finish, as approved.

E. Troweled Finish:

1. Provide a floated finish as described above, followed by a power troweling and then a hand troweling.
   a. Produce an initial surface which is relatively free from defects, but which still may show some trowel marks.
   b. Provide hand troweling when a ringing sound is produced as the trowel is moved over the surface.
   c. Thoroughly consolidate the surface by hand troweling.

2. Provide a finished surface essentially free from trowel marks, uniform in texture and appearance.
3. On surfaces intended to support floor coverings, use grinding or other means as necessary and remove all defects of such magnitude as would show through the floor covering.

F. Broomed Trowel Finish:

1. Power float to trueness within the specified tolerance, and provide one-pass steel troweling. After troweling, draw a broom across surface to a light transverse scored texture, as approved.

G. Exposed Aggregate Finish:

1. Allow concrete to receive exposed aggregate finish to dry free of surface water before placing finish. Do not use accelerators or retarders in concrete to receive surface retardant treatment.
2. Apply surface retardant by roller or spray, coverage 80 to 100 square feet each gallon of retardant or as otherwise recommended by retardant manufacturer's label instructions.
3. Removing Retardant Treated Mortar:
   a. Within 12 to 24 hours, hose surface with water and scrub with stiff broom or brush, to approximately 1/8" depth; actual depth as determined by approved sample panel.
   b. Continue brushing until selected aggregate is exposed, but not dislodged, and top surface of stainless steel control joints is exposed.
   c. Clean off excess and removed material, protect and cure as hereinafter specified.

H. "Tactile" Finish:

1. After floating and applying broom finish, imprint surface of handicap curb cuts with a diamond pattern texture using an expanded metal grate imprinting tool, as approved.

I. Non-Slip Finish:

1. After troweling, obtain finish by dragging a strip of clean, wet burlap across the slab and curb surfaces to produce a fine, granular, or sandy textured surface without disfiguring marks.
2. Round edges and joints in curbs with an edger having a radius of ¼".

J. Exterior Control Joint & Slab Edge Treatment:

1. Steel tool all control joints, all exposed perimeter edges, and edges of expansion joints, prior to filling with sealant, to a smooth bullnose form, using an edger having a radius of ¼", as approved.
2. Form control joints in uniform straight lines, spaced no greater than 5 feet apart. Coordinate exact locations and alignment with Architect.

3.4 CURING AND PROTECTION

A. The Contractor shall use all necessary precautions to keep cracking of all concrete work to an absolute minimum. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures, and mechanical injury.

1. Maintain curing procedures used for seven (7) days at minimum temperature of 50° F; if mean daily temperature drops below 40° F during this period, extend curing period an equal number of days or provide temporary heat or additional protection to maintain specified minimum temperature of air in contact with concrete.

B. Temperature, wind, and humidity;

1. When concrete slab placements are subjected to high temperatures, wind and/or low humidity the Architect may require the use of the specified evaporation retarder to minimize plastic cracking. The compound may be required to be applied one or more times during the finishing operation. The initial application is usually made after the strike-off operation.
2. Cold weather:
   a. When the mean daily temperature outdoors is less than 40° F, maintain the temperature of the concrete between 50° F and 70° F for the required curing period.
   b. When necessary, provide a proper and adequate heating system capable of maintaining the required heat without injury due to concentration of heat.
   c. Do not use combustion heaters during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
   d. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   e. Only the specified non-corrosive non-chloride accelerator shall be used. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.
3. Hot weather:
   a. When necessary, provide wind breaks, fog spraying, shading, sprinkling, ponding, or wet covering with a light colored material, applying as quickly as concrete hardening and finishing operations will allow.
4. Rate of temperature change:
   a. Keep the temperature of the air immediately adjacent to the concrete during and immediately following the curing period as uniform as possible and not exceeding a change of 5° F in any one hour period, or 50° F in any 24 hour period.

C. Curing Walls & Formed Surfaces:

1. Where forms are exposed to the sun, minimize moisture loss by keeping the forms wet until they can be removed safely.
2. In hot weather, immediately after forms have been removed, cure by spraying walls with liquid membrane-forming compound specified above for exterior walls, applied at not less than the manufacturer's specified and recommended rate.
3. In freezing weather, protect in accordance with ACI 301.

D. Curing Exterior Slabs:

1. Spray slabs with liquid membrane-forming compound specified above for exterior slabs, applied at not less than the manufacturer's specified and recommended rate.

E. Curing Interior Slabs:

1. For Recessed Slab Surfaces: Install appropriate sheeting as specified above, installed over slabs immediately upon completion of surface finish work as work proceeds. Lap 3 inches and tape or otherwise seal edges and hold down by adequate means to prevent dislodgment. Maintain covering for a minimum of seven (7) days. Repair any damage to

membrane which allows escape of slab moisture. Maintain membrane upkeep until full removal.

2. For Slabs to Receive Resilient and Carpet Floor Coverings:
   a. Spray new slab surfaces with the curing compound specified above, applied at not less than the manufacturer's specified and recommended rate and in accordance with manufacturer's written instructions.
   b. In addition, all floor slabs shall be covered with blankets for a minimum of 72 hours after pouring.
3. For Slabs to be Left Exposed and Sealed:
   a. Spray new slab surfaces with the curing compound specified above, applied at not less than the manufacturer's specified and recommended rate and in accordance with manufacturer's written instructions.
   b. In addition, all floor slabs shall be covered with blankets for a minimum of 72 hours after pouring.
   c. After curing compound has fully dried per manufacturer's recommendations, Contractor shall cover such slab surfaces with protective sheeting as necessary to avoid damage due to subsequent construction work and prior to final finishing of such floor surfaces as specified below.
4. For Slabs to be Ground and Polished:
   a. Spray new slab surfaces with the curing compound specified above, applied at not less than the manufacturer's specified and recommended rate and in accordance with manufacturer's written instructions.
   b. In addition, all floor slabs shall be covered with blankets for a minimum of 72 hours after pouring.

F. Protection from mechanical injury and staining:

1. During the curing period, protect all concrete during period from damaging mechanical disturbances, more especially load stresses, heavy shock, and excessive vibration.
2. Protect finished concrete surfaces from damage from construction equipment, materials and methods, from application of curing procedures, and from rain and running water.
3. Do not load self-supporting structures in such a way as to overstress the concrete.
4. Take care to prevent staining to concrete surfaces which will receive a polished finish and other surfaces to be exposed in the final construction.
5. After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

3.5 APPLIED FINISHES

A. Sealed Finish: Where sealed finish is scheduled

1. Apply sealer strictly in accordance with the sealer manufacturer's written application instructions and recommendations, for a uniform, low gloss sheen finish.

END OF SECTION 03 34 50

SECTION 04 06 50 - MASONRY MORTAR & GROUT

PART 1 – GENERAL

1.1 DESCRIPTION

A. GENERAL REQUIREMENTS

1. Drawings and general provisions of the Contract Documents including General, Supplementary and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. RELATED WORK IN OTHER SECTIONS

1. Unit masonry work covered under Section 04 22 00.

1.2 QUALITY ASSURANCE

A. INSPECTIONS & TESTS

1. Field testing of grout and pre-construction and construction-site testing of mortar.
2. Contractor shall furnish mortar and grout materials for testing; follow Architect’s directions for any required jobsite alterations to mortar and grout mixes.

1.3 SUBMITTALS

A. MATERIAL, MIX CERTIFICATES

1. If mortar and grout are plant-mixed, furnish certificate from supplier attesting to compliance with specified requirements.

B. SAMPLES

1. Provide samples of mortar as part of sample panels specified to be provided under Section 042200.

1.4 PRODUCT DELIVERY, STORAGE & HANDLING

A. JOBSITE MATERIAL STORAGE

1. Store under roof, off ground; protect from elements.

1.5 JOB CONDITIONS

A. HOT AND COLD WEATHER WORK

1. Comply with the hot and cold weather construction requirements described in the IBC and TMS 402/602.

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL

1. Conform to ASTM C270 for unit masonry mortar, ASTM C476 for grout.

B. PORTLAND CEMENT

1. ASTM C150, Type II; gray color for all work unless note or directed otherwise by the Architect.

C. LIME

1. Hydrated lime ASTM C207, Type S.

D. MORTAR AGGREGATE

1. Furnish ASTM C144 clean, sharp, well-graded aggregate free from injurious amounts of dust, lumps of shale, alkali, surface coatings, and organic matter.

E. GROUT AGGREGATE

1. For fine grout, furnish fine aggregate meeting grading requirements of ASTM C404 Table I, size 1, 3/8-inch maximum.

F. WATER

1. Clean, potable, fresh.

G. MORTAR COLOR

1. Color of mortar shall be as specified by the Architect and shall be subject to approval by the Architect.

H. ADMIXTURES

1. Anti-Freeze Compounds: Liquid, salts, or other substances to lower the freezing point in mortar NOT permitted.

I. FLY ASH

1. Fly ash shall conform to ASTM C618, Class F.

2.2 MORTAR TYPES FOR UNIT MASONRY WORK

A. GENERAL

1. All mortar compressive strengths and types listed hereinafter for various uses shall be those conforming to and referenced in ASTM C270 for mortar for brick masonry and CMU block masonry and veneer setting mortar.
2. Measure materials for mortar in method that specified or designed proportions can be controlled and accurately maintained.

B. COMPRESSIVE STRENGTHS

Mortar Type ASTM C270	Average Compressive Strength at 28 Days psi

M 2500

C. MORTAR PROPORTIONS (PARTS) BY VOLUME (C270)

1. Mortar Type M:
   Portland cement: 1
   Hydrated lime or lime putty: 1/4
   Aggregate, damp, loose, passing a 16 mesh sieve: 2-1/4 to 3 times sum of cement and lime volumes.
2. Mortar Design: Exact proportions of mortar mixes specified herein to be determined by an approved independent laboratory using ingredients proposed to be furnished on the work and following procedures set forth for pre-construction evaluation of mortar mixes.

2.3 GROUT TYPES FOR REINFORCED MASONRY WORK

A. GENERAL

1. Grout compressive strengths and types listed hereinafter for various uses shall be those conforming to and referenced in ASTM C476.
2. Design to attain (1) minimum compressive strength of 2500 psi in 28 days, average of three 3-1/2 x 3-1/2 x 7 inch cubes, (2) water retention (flow after suction, min., percent of original flow) of 70, and (3) air content (volume, max. percent) of 18.
3. Measure materials for grout in method that specified or designed proportions can be controlled and accurately maintained.

B. GROUT PROPORTIONS (PARTS) BY VOLUME (C476)

1. Fine Aggregate Grout:
   Portland cement : 1
   Hydrated lime or lime putty : 0 to 1/10
   Fine aggregate, damp, loose : 2-1/4 to 3 times sum of cement and lime volumes.
2. Course Aggregate Grout:
   Portland cement : 1
   Hydrated lime or lime putty : 0 to 1/10
   Fine aggregate, damp, loose : 2-1/4 to 3 times sum of cement and lime volumes.
   Course aggregate, damp, loose : 1 to 2 times sum of cement and lime volumes.

C. FLY ASH

1. Where fly ash is used, shall replace portland cement at a maximum rate of 20% by weight.

2.4 MORTAR & GROUT MIXING

A. MACHINE MIXING

1. Mix mortar for a minimum period of three minutes, mix grout for five minutes minimum; mix in as approved mechanical batch mixer.

B. HAND MIXING

1. For small batches of setting mortar and grout only, then only upon approval of Architect.

C. MORTAR WORKABILITY & CONSISTENCY

1. Maintain mortar on the board sufficiently plastic to produce easy working with trowel, use water only in minimum quantity for workability.
2. Discard mortar mixed in excess of two hours before placing.
3. Do not re-temper mortar at the mixer.

D. GROUT CONSISTENCY

1. Maintain 5-8 inch slump for grout used for units with low absorption and up to 10-inch slump for high absorption units.
2. Do not add water unless given specific approval by Special Inspector at the jobsite.

PART 3 - EXECUTION

3.1 APPLICATION

A. MORTAR TYPES & USES

1. Use Type M mortar for all brick and stone veneer and all concrete masonry unit veneer and block work.

B. GROUT TYPES & USES

1. Use course or fine grout, as conditions warrant, for grouting voids of concrete masonry unit block work, and grouted brick work.

3.2 FIELD QUALITY CONTROL

A. INSPECTIONS & TESTS

1. Field inspection and testing shall be performed. Contractor shall comply with the requirements of the Owner's testing and inspection agency.
2. General: Independent laboratory to test exact proportions of mortar mixes using the same aggregate and other materials furnished by Contractor proposed to be used on the work; material samplings shall comply with ASTM C780, Article 9, "Sampling".
3. Pre-construction evaluation of mortars:
   a. Provide pre-construction evaluation of mortars in compliance with ASTM C780 using test methods and procedures specified therein in Annexes A1 through A7, inclusive.
   b. Under test method Annex A6, test mortar mixes for compliance with specified compressive strengths.
   c. Should test specimens fail to meet specified compressive strengths, immediately notify Architect and Contractor.
4. Construction-site evaluation of mortars:
   a. Take three 2 x 4 inch cylinder specimens for each 30 cu. yd of mortar or fraction thereof being placed each day, conforming to ASTM C 109 or an approved equal ASTM standard test method.
   b. Test mortar specimens for compliance with specified compressive strengths as indicated on Structural Drawings.
   c. Should test specimens fail to meet specified compressive strengths, immediately notify Architect and Contractor; perform further testing of construction-site mortar when so directed by Architect.
5. Construction-site evaluation of grout:
   a. Take three specimens for each 30 cu. yd. of grout or fraction thereof being placed each day, conforming to ASTM C 1019 or an approved equal ASTM standard test method.
   b. Test grout specimens for compliance with specified compressive strengths as indicated on Structural Drawings.

c. Should test specimens fail to meet specified compressive strengths, immediately notify Architect and Contractor; perform further testing of construction-site grout when so directed by Architect.

END OF SECTION 04 06 50

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Drawings and general provisions of the Contract Documents including General, Supplementary and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division I of these specifications.
2. Reinforcing steel for walls and for dowels tying masonry work to foundation wall construction specified under Section 03 20 00.
3. Mortar and grout covered under Section 04 06 50.
4. Except as noted hereinafter, embedded anchors for structural steel members and steel fabrications furnished under Sections 05 10 00 and 05 50 00, respectively; to be installed under work of this Section.
5. Penetrating water repellent for masonry in section 07 19 00 – Water Repellents

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Inspections and Tests

1. Periodic special on-site inspection/observation by the Testing Agency is required during placement of reinforced and/or fully grouted concrete masonry. Tests will be performed as required by the International Building Code, as adopted by the local jurisdiction having authority and these specifications.
2. Inspections: Will include, but not necessarily be limited to, the following:
   a. Check reinforcing steel in place.
   b. Inspect all cells and clean-outs.
   c. Inspect grouting operation.
   d. Refer to Structural Notes for additional inspection requirements.
3. Testing: Will include, but not necessarily be limited to, the following:
   a. Test materials for compliance with specifications.
   b. A set of five masonry prisms shall be built and tested in accordance with ASTM C 1314 or an approved equal ASTM standard test method prior to the start of construction. Materials used for the construction of the prisms shall be taken from those specified to be used in the Project. Prisms shall be constructed under the observation of the engineer or special inspector or an approved agency and tested by an approved agency.
   c. A set of three (3) prisms shall be built and tested during construction in accordance with ASTM C 1314 or an approved equal ASTM standard test method for each 5,000 square feet of wall area, but not less than one (1) set of three (3) prisms for the Project.

d. Make report of test results in writing and expedited to Contractor, Architect, Owner, and the Structural Engineer. Include in test reports the project identification name and number, date, name of subcontractor, name of testing service and identification number.

C. Pre-Installation Meeting

1. Approximately two weeks prior to scheduled commencement of masonry installation and associated work, meet at project site with masonry subcontractor, associated finish coatings Installer(s), Architect, Owner, and other representatives directly concerned with performance of the work including (as applicable) test agencies and governing authorities.
2. Review foreseeable methods and procedures related to masonry work, including, but not necessarily limited to, the following:
   a. Inspect and discuss condition of substrates, penetrations and other preparatory work performed by other trades.
   b. Review masonry requirements (drawings, specifications, and other contract documents).
   c. Review required submittals, both completed and yet to be completed.
   d. Review and finalize construction schedule related to masonry work and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   e. Review required inspection, certifying, and material usage accounting procedures.
   f. Review weather and forecasted weather conditions as they may apply, and procedures for coping with unfavorable conditions, including requirements for temporary protection.

1.3 SUBMITTALS

A. Certificates

1. For masonry work furnish for approval, attesting conformance to specified ASTM Designation and Type for each different type of masonry unit.

B. Manufacturer's Data

1. Furnish product information for masonry products. Include manufacturer's specifications including installation instructions and general recommendations for the type of products.

C. Samples

1. Sample Units: Furnish one (1) sample board of each unit type, of colors and textures required, for approval.
2. Sample Mock-up Panels
   a. Erect on site, for approval and application of finish materials, using full size units; provide panels sized 4x8 feet of the following:
      1) One panel for each type of CMU finish surface (split-faced, smooth faced, etc.) of each color required, including all masonry types and associated sill blocks.
      2) Each panel to show differing conditions, and to incorporate sill members where applicable.
      3) In addition, panels shall incorporate various backup substrates including associated thru-wall flashings, window openings, flashings, shelf angles, weeps, air vent tubes, ties, expansion/control joints, joint sealant, and other accessory products as applicable for the project.
   b. Approved panels to remain as control until removal is approved by Architect.

D. Masonry Reinforcement Shop Drawings

1. The Contractor shall submit to the Architect, for review, complete and reviewed, reinforcing steel bending and placing diagrams prepared by or under the supervision of a qualified steel detailer; prepare in accordance with ACI 315.
2. Shop drawings shall show details, dimensions and schedules for the fabrication and placing of reinforcing and accessories. Fabrication of items shown in shop drawings shall not begin until Architect has completed his review.
3. Shop drawings for masonry reinforcement shall be an 'overlay' of the masonry wall elevations. Detail, fabricate, and place per ACI 315. Reinforcing shop drawing elevations shall show all vertical and horizontal reinforcing layouts; special reinforcement at lintels and jambs at doors, windows, mechanical, plumbing, and electrical openings, and as called out on Structural Drawings.
4. Include materials list of items proposed to be provided under this Section, together with manufacturer's specifications and other data needed to prove compliance with specified requirements.

E. Masonry Wall Coordination Drawings

1. Contractor shall be responsible for providing masonry wall coordination drawings for all concrete masonry unit walls. Drawings shall consist of wall elevations drawn to scale at not less than ¼" = 1'-0". All information required herein for a given wall shall be shown on the same wall elevation drawing to facilitate coordination between trades.
2. Wall elevations shall include dimensioned sizes and locations for all door, window, and mechanical, plumbing, and electrical openings and penetrations, beam and joist bearing pockets, ledger angles, embedded plate connections, control joints, and anchor bolts. All miscellaneous steel to be embedded in the masonry unit wall shall be referenced by shop drawing mark number or structural detail number. Care shall be taken to locate mechanical, electrical, and plumbing penetrations away from wall jambs and lintels.
3. Masonry wall coordination drawings shall be reviewed and approved by interfacing trades prior to submittal to the Architect.

F. Shop drawings are interpretations of and are supplemental to the design drawings and specifications. Their intent is to demonstrate to Architect that this Contractor has understood the design concept, and to provide detailed information necessary for the fabrication, assembly, and installation of the products and materials specified. Neither the shop drawings nor comments placed on them by the Architect shall be construed as being change orders.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver all materials dry; store all materials at site off ground, adequately covered to protect from moisture and other damage until placed in the work.

B. Contractor shall allow for and discard all chipped or broken masonry.

1.5 JOB CONDITIONS

A. Protection of Work, Weather and Work Suspensions

1. Wet Weather: General Contractor shall provide and maintain approved protective cover over exposed masonry work during placing and after placement, until such construction is sealed. Contractor shall cover top of all masonry work with minimum 10 mil visqueen sheeting, properly secured, to protect the work from filling up with rain water or other precipitation until the final capping of such work occurs.
2. Cold Weather: When temperature is or expected to be below 40° F during and for 48 hours after placing, heat materials and provide adequate enclosures to maintain temperature above

40° F; obtain approval of protection methods prior to proceeding. Also comply with the cold weather requirements described in the IBC and TMS 402/602. Protect all masonry from freezing for a minimum of 4 days after laying, in approved manner. Use NO antifreeze admixtures or calcium chloride in mortar for any masonry work.

3. Hot Weather: Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of 90° F in the shade, with relative humidity less than 50%. Also comply with the hot weather requirements described in the 2018 IBC and TMS 402/602.

B. Cooperation with Other Trades

1. Obtain exact sizes of openings for ducts and pipes specified in other Sections; properly build around same. Build in and coordinate with and for work furnished by other trades as required; ductwork man-way restraints and their anchors, bolts, inserts, shelf angles, and other items as shown.
2. Coordination with Water Repellent Work: Refer to Section 04 22 00, Wet Weather Protection for Masonry Work. All coordination necessary with water repellent coating applicator as required to ensure all such application work is fully accomplished in a timely and proper manner, is the sole responsibility of the General Contractor. As a part of such coordination, General Contractor shall provide all new masonry construction with complete and proper protection from precipitation as specified above, both during and following masonry wall construction, until the sealing process is complete.
3. Masonry Subcontractor Coordination Work: Coordinate installation of reglets set in masonry work with sheet metal flashings installed as required to ensure proper locations of reglets for all such flashing work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Masonry Block & Veneer Units

1. Provide light weight or normal weight hollow load-bearing concrete masonry units complying with ASTM C-90 units, shape as directed and approved by the Architect. Concrete masonry units shall have a minimum compressive strength of 3250 psi at 28 days. See Architectural drawings for layup pattern and mortar joint locations. Design F'm = 2500 psi.
    a. The maximum moisture content of concrete masonry block units shall be as follows:

Linear Shrinkage, %	Moisture Content, Max, % of Total Absorption (Average of 3 Units)
0.03 or less	35
From 0.03 to 0.045	30
0.045 to 0.065 max	25

2. Dimensions:
    a. At exposed CMU, provide units of the dimensions specified by the Architect.
    b. Where dimensions are not otherwise indicated, provide units having nominal face dimensions of 16" long by 8" high by the depth shown or otherwise required.
3. Color shall be as directed by the Architect where exposed to view. Standard grey units may be used where they are totally concealed from view.

5. Finish shall be as directed by the Architect and as shown on the Drawings.
6. Provide accessory shapes as indicated or otherwise required.
7. Furnish bond beam units for continuous bond beam courses as shown or otherwise required.
8. Use open end units wherever possible.
9. Integral waterproofing admixture shall NOT be used in CMU.

C. Bars for Vertical & Horizontal Reinforcing

1. Furnish vertical and horizontal reinforcing of ASTM A615, Grade 60. All reinforcing bars which are to be welded shall conform to ASTM A706. Use bars of sizes and quantities shown and noted on Structural Drawings and related Details.
2. Furnishing and placement of dowels associated with masonry work, to be set into concrete structures as indicated on Structural Drawings and specified therefore under Section 032000, shall be the responsibility of masonry subcontractor for work of this Section.
3. Vertical bars to be of lengths and laps as required for low-lift grout work in lifts not exceeding five feet; length of bar laps as shown on Drawings.
4. Furnish additional reinforcing as specified under Structural Notes or as otherwise indicated on Structural Drawings.
5. Bending of bars per ACI 318.
6. Wire reinforcement per ASTM A82.

D. Expansion/Control Joints

1. Furnish Dur-O-Wal Inc. “D/A 2002”, Wire-Bond “2901” Regular PVC Control Joint, or equal; for installation in closed end blocks with sash grooves at all CMU control joints.

E. Masonry Reglets

1. Furnish Fry Reglet Corp. “Springlok Type MA”, O’Keeffe’s Inc. “Type MI,” or equal, masonry reglet constructed of 24 ga. Stainless steel, for recessed installation into masonry where indicated. Furnish reglets complete with manufacturer’s preformed one-piece inside and outside corner sections, plus end covers for exposed ends of reglets, except where other flashings are provided as part of roofing assemblies.

F. Sheet Metal Flashings

1. Sheet metal flashings to be incorporated into masonry work as specified; masonry subcontractor for work of this Section shall furnish said flashings as specified, of the various types, sizes and configurations indicated.
2. Sheet metal flashing shall have prepainted finish same as specified for prepainted galvanized flashing sheets; colors as selected by Architect for the various types/applications.

G. Cleaning Solution

1. Furnish ProSoCo Inc. “600 Detergent” masonry cleaner, Diedrich Technologies, Inc. “202 Detergent,” or equal.

H. Bar Positioners
1. At walls with a double mat of vertical reinforcing, furnish bar positioners to maintain required clearances.

PART 3 - EXECUTION

3.1 INSPECTION OF PRIOR WORK

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Inspect bearing surfaces and related work in place for existing conditions.

C. See that dowels, masonry anchors, shelf angles and weld plates, as applicable, are properly placed.

D. Check that hollow metal door frames are secured in place and have received full application of required protective coating on all concealed frame surfaces to receive grout as specified herein.

E. If deficiencies or errors are found, notify those trades responsible that corrections are made as approved before starting work.

3.2 PREPARATION

A. Preparation for New Masonry Installation

1. Clean top surfaces of existing bearing surfaces and work in place removing all foreign material before starting or resuming work.
2. Wet masonry units only as required to assure watertight mortar joint bond.
3. See that building wrap moisture barrier is installed to backup wall substrates as shown and specified.

3.3 MASONRY INSTALLATION

A. Workmanship, General

1. Except as otherwise noted or indicated, lay all work to true plumb and level lines, maintaining established approved module, coursing patterns and uniform joints for each type of work shown. Use story pole for vertical coursing dimensions.
2. Use stock units wherever possible; where cutting is required use high speed masonry power saw. Masonry units utilized on an exposed finish surface shall be free of chips, breakage, or other imperfections.
3. Unless otherwise noted, lay all masonry work in a full bed of mortar, head and vertical joints completely filled. Use mortar and grout types specified herein and under Section 040650 for the work and as described hereinafter.
4. Install reinforcing, ties, and anchors for work of other trades as work proceeds.
5. Provide complete coordination of installation of mechanical plumbing, electrical conduit, and the like.
6. Unless otherwise specified hereinafter, omit filling joints with mortar in joints of the following types: Expansion, control, and seismic.
7. Cut and remove split face to a smooth finish as required at surfaces abutting steel ledgers, door and window framing, as applicable; elsewhere where shown.

B. Concrete Masonry Block Unit Installation

1. General

a. Lay units by face shell bedding method, in running bond with full head joints conforming to TMS 402/602, of masonry type, face pattern, and size courses as directed by the Architect for the various wall structures. Use open-end units whenever possible.
b. Install units with all open cells placed vertically.
c. Lay continuous bond beam courses in locations indicated.
d. Make all joints approximately 3/8” width.
e. Anchor units to wall and foundation structures as shown.
f. Cap tops of exterior screen walls as directed by the Architect.
g. Clean the top surface of foundation free from dirt, debris, and laitance, and expose the aggregate prior to start of installing first course.
h. Accurately fit the units to plumbing ducts, openings, and other interfaces, neatly patching all holes.
i. Keep the walls continually clean, preventing grout and mortar stains. If grout does run over, clean immediately.
j. Do not use chipped or broken units. If such units are discovered in the finished wall, the Architect may require their immediate removal and replacement with new units at no additional cost to the Owner. Refacing of masonry units will be allowed only after written permission is given by the Architect.

2. Built-in Work
   a. As the work progresses, build in built-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items, except at expansion/control joints.
   b. Install reglets, control joints, veneer ties and reinforcement as work proceeds, as applicable, installed as shown for the various conditions and/or otherwise specified herein.
   c. As the work proceeds, fill hollow metal frames solid with grout. Leave space between hollow metal frames and exterior masonry for subsequent application of sealant.
3. Finishing Mortar Joints
   a. Tool all joints, whether exposed or concealed, with steel tool to a concave profile, as approved.

C. Control Joints

1. Install continuous along all vertical expansion joints in full depth masonry or masonry veneer work, as detailed, with back edge flush with back (concealed) face of respective masonry units. Remove all mortar from remaining portions of expansion joint for subsequent application of sealant as specified.

D. Installation Of Masonry Reinforcing

1. Install deformed reinforcing steel bars vertically and horizontally in cells of concrete masonry unit work, including bond beams, sized and spaced as shown, prior to grouting.
2. Vertical bar positioners are required where a double mat of reinforcing occurs. Engage vertical reinforcing with "vertical bar positioners" and with bar dowels installed under work of Section 03 20 00.
3. Provide reinforcement as shown on the Drawings, fully embedded in grout and not in mortar or mortar joints.
4. Install all other reinforcing as specified in Structural Notes or otherwise indicated on Drawings and related details.

E. Low Lift Grout Work

1. Install grout specified in Section 04 06 50 in low lifts not exceeding 5 feet, completely filling all voids of CMU. Grout around vertical reinforcing, anchors, weld plates, etc.; at all bond beams install grout around horizontal reinforcing, completely filling bond beam voids. Install grout in all cells of masonry units. All grout shall be vibrated and re-vibrated.

F. High Lift Grout Work

1. Where approved by the Architect and where cleanout openings will be concealed in the final construction, install grout specified in Section 040650 in high lifts not exceeding 8'-0". Completely fill all voids of CMU. Grout around vertical reinforcing, anchors, weld plates, etc.; at all bond beams install grout around horizontal reinforcing, completely filling bond beam voids. Install grout in all cells of masonry units. All grout shall be vibrated and re-vibrated.
2. Cut cleanout openings shall be provided at the bottom of each lift for cleaning and inspection.

G. Masonry Reglets

1. Install in masonry joint, level and true, with top of reglet at least 7 inches above adjacent roofing surface, unless otherwise indicated. Coordinate installation with roof flashing.
2. At walls abutting sloped roofs, install reglets using the step flashing method.
3. All reglet joints shall be lapped 3 inches minimum, lapped away from prevailing winds, with corners mitered, and all joints sealed watertight.
4. Turn counterflashings and end covers over to sheet metal trade for installation.

H. Sheet Metal Flashings

1. Install all flashings integral with masonry work as masonry work proceeds, of prepainted colors as selected, complete as detailed and otherwise required for the various conditions of the work to provide watertight installations.

3.4 POINTING & CLEANING

A. Pointing – New Work

1. On completion of new work, point all exposed masonry work surfaces filling all holes and cracks. Remove all loose mortar and defective work and re-point as required until it is approved.

B. Cleaning

1. Clean all surfaces of concrete masonry unit surfaces which are to be left exposed. Clean surfaces with cleaning solution specified above.
2. Wet surfaces with water before applying cleaning solution; after application of cleaning solution, water rinse all solution off the surface.
3. Protect adjacent materials from damage from cleaning solution.
4. Leave all surfaces clean, free from mortar and all stains, ready for respective water repellent and paint coatings, as applicable.

END OF SECTION 04 22 00

SECTION 05 10 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Requirements

1. Drawings and general provisions of the Contract Documents including General, Special and other Conditions and Division 1, “General Requirements” Section, apply to the work specified in this Section.

B. General Description of Work

1. In general, work under this Section includes providing structural steel as shown on the Drawings, specified herein, and needed for a complete and proper installation in each case.

C. Related Work in Other Sections

1. Section 05 20 00: Steel Joists
2. Section 05 31 00: Steel Floor and Roof Deck
3. Section 05 50 00: Miscellaneous Metal

1.2 QUALITY ASSURANCE

A. STANDARD SPECIFICATIONS & CODE OF PRACTICE

1. Standard Specifications:
   a. "Steel Construction Manual", current edition, as issued by the American Institute of Steel Construction (AISC); hereinafter called “Standard No. 1”.
   b. Unless otherwise noted, furnish material conforming to the Standard No. 1 of types shown on the Structural Drawings.
2. Code of Practice:
   a. AISC "Code of Standard Practice for Steel Buildings and Bridges", current edition, hereinafter called "Standard No. 2”.
   b. Unless otherwise noted, wherever the term "Owner" is used in Standard No. 2, it shall mean "General Contractor or other trades, all as specified in other Sections of these Specifications".

B. STANDARD SPECIFICATIONS FOR SURFACE PREPARATION FOR PRIMING

1. Steel Structures Painting Council (SSPC) "SSPC-SP1 Solvent Cleaning", hereinafter called "SP1"; "SSPC-SP3 Power Tool Cleaning", hereinafter called "SP3"; and "SSPC-SP6 Commercial Blast Cleaning", hereinafter called "SP6".

C. INSPECTIONS & TESTING
1. Cooperate with inspector; permit inspector's access to all places where work is being done.
2. Welding: Verify conformance with applicable Sections of Division 5. All welding shall be subject to special inspection.
3. Structural Steel Framing & Fabrications:

a. General: Tests will be performed as required by the International Building Code, Chapter 17, as adopted by local jurisdiction and these specifications.
b. Shop Bolted Connections: Inspect in accordance with AISC specifications.
c. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
    i. Verify use of certified welders, and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
    ii. Perform visual inspection of all welds including fillet welds.
    iii. Perform tests of complete penetration welds as required by technical specifications as follows. Inspection procedures listed are to be used at Testing Laboratory's option.
        1) Radiographic Inspection: ASTM E94; minimum quality level "2-2T".
        2) Ultrasonic Inspection: ASTM E164.
        3) Magnetic Particle Testing: ASTM E1444
d. Field Bolted Connections: Inspect in accordance with AISC specifications.
e. Field Welding: Inspect and test during erection of structural steel as follows:
    i. Verify use of certified welders, (AWS "Standard Qualification Procedure) and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies and submit copies of such reports to Contractor, Architect, Owner, Structural Engineer, and Local Building Department.
    ii. Perform visual inspection of all welds including fillet welds.
    iii. Perform tests of full penetration welds as required by technical specifications as follows:
        1) Radiographic Inspection: ASTM E94; minimum quality level "Z-2T".
        2) Ultrasonic Inspection: ASTM E164.
        3) Magnetic Particle Testing: ASTM E1444
f. Testing Program Summary: Testing agency special inspector shall submit a summary of the proposed testing program for review and approval; submit directly to Contractor, Architect, Owner, Structural Engineer, and Local Building Department.

D. QUALIFICATIONS

1. Fabricator/Erector: Shall have AISC Building Fabricator Certification. Shall have appropriate facilities and an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section as indicated on Drawings. Shall have minimum of five (5) years of experience and be able, upon request, to show framing of size, materials, and scope similar to work of this Contract.
2. Welders: Shall be certified by the American Welding Society (AWS). Welders of structural steel shall have qualification as required by AWS D1.1. Each welder shall mark his identification symbol on his work.

E. CONNECTION IDENTIFICATION

1. Each person installing connections shall be assigned an identifying symbol or mark, and all shop and field connections shall be so identified so that the Owner's independent testing agency can refer to the person making the connection.

1.3 SUBMITTALS

A. SHOP DRAWINGS

1. Furnish complete, checked shop drawings for approval.

2. Include complete information for the fabrication and erection of the structure's components, including all required dimensions, details, necessary accessory items as described in the Standard No. 1. Show sizes, configurations, spacing and location of trusses, connections, bridging, reinforcing, anchoring, cambers, loads, and other pertinent data, and showing welded connections and the length thereof, using AWS standard welding symbols in accordance with AWS 2.4. Clearly designate all portions of members, connections, and welds which are required to be fabricated and handled per the requirements for architecturally exposed structural steel (AESS).
3. Provide framing plans showing locations and sizes of holes in beam webs for coordination with sprinkler pipe layouts.
4. Provide setting drawings, templates, and directions for installing anchor bolts and other required anchors.
5. Include with each detail shown on the shop drawings a reference to the Architect's and Structural Engineer's drawings and details, where applicable.
6. Calculate, obtain, and show all additional dimensions required which are not otherwise specifically set forth on Drawings. Coordinate dimensions with all connected and adjacent work. Verify all applicable dimensions.
7. Include manufacturer's specifications and other data needed to prove compliance with specified requirements.
8. Piece mark notations shall be indicated on layout drawings.
9. Shop drawings shall not be reproductions of Contract Drawings.
10. Shop drawings are interpretations of and are supplemental to the design drawings and specifications. Their intent is to demonstrate to the Architect that this Contractor has understood the design concept, and to provide detailed information necessary for the fabrication, assembly, and installation of the products and materials specified. Neither the shop drawings nor comments placed on them by the Architect shall be construed as being change orders.

B. CERTIFICATIONS

1. Submit certification of materials with copies of mill reports for each heat and type of steel used.
2. Submit complete manufacturer's mill test reports for bolts, nuts and washers. Markings and chemistry shall also comply with specification. Certification numbers shall appear on product containers and correspond to certification numbers on mill test report to be accepted. Mill test report shall be supplied to both the purchaser and Owner's independent testing agency.

C. PLACEMENT PLANS

1. Submit placement plans and details as required for the satisfactory placing, connection, and anchorage of all structural members.

D. WELDING PROCEDURES

1. Submit detailed welding procedures in accordance to ASW D1.1. Submit to the Owner's independent testing agency the detailed description of welding procedures proposed for use on structural metals. Obtain approval prior to any welding operation. Furnish joint welding procedure qualification tests, as required by AWS D1.1.

1.4 PRODUCT DELIVERY, STORAGE & HANDLING

A. Stacking & Shipping

1. Handle and stack all materials carefully to prevent deformation or damage. Store all structural steel members carefully on substantial timbers and blocking, so arranged that the steel will be properly drained. Special care shall be taken to avoid any twisting,

deformation, or damage to the surface of members designated as architecturally exposed structural steel.

2. Deliver materials to the job site properly marked to identify the location for which they are intended.
3. Use markings corresponding to markings shown on the reviewed Shop Drawings.
4. Keep primed steel members from touching each other by using wooden separators for stacking. Take measures to avoid damaging prime coat while stacking, loading or unloading and use wooden protectors to prevent damage from chain or cable cinches. Provide special protection and handling of all members designated as architecturally exposed structural steel.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Architecturally Exposed Structural Steel: All steel and connections which will be exposed in the final construction shall be designated as architecturally exposed structural steel (AESS).

B. Structural Steel

1. Provide carbon steel shapes, plates, and bars of structural quality, sizes, and types noted on Drawings and specified herein, for use in welded and bolted construction. Steel manufactured by the Acid Bessemer process shall not be used for structural purposes. Steel which, in the opinion of the Owner's independent testing agency, is badly corroded or physically damaged shall not be incorporated in the work.
   a. Shapes, Threaded Rods and Plates: All 'W' and 'H' shapes shall conform to ASTM A992, Grade 50. All other pieces ASTM A36, Grade 36, unless otherwise noted on Structural Drawings.
   b. Steel Tubing: ASTM A500 Grade C, Fy = 50 ksi unless otherwise noted on Drawings.
   c. Steel Pipe: Unless otherwise shown on Drawings, ASTM A53, Type E or S, Grade B, Fy = 36 ksi.
   d. Substitutions: Should substitutions be required due to non-availability of sections shown, obtain Architect's prior approval. No substitutions permitted with members lighter in weight than shown on Drawings.

D. Fasteners

1. Standard Fasteners: Low-carbon steel externally and internally threaded fasteners conforming to requirements of ASTM A307, Grade A except as otherwise noted on Structural Drawings. All bolts, nuts and washers exposed to the weather shall be hot-dipped galvanized.
   a. Anchor Bolts: Headed type with heavy hexagonal nuts for all connections unless otherwise indicated. Include lock washers under nuts or self-locking nuts. Anchor bolts shall conform to ASTM F1554 Grade 36, unless noted otherwise.
   b. Unfinished Threaded Fasteners: Provide either hexagonal or square heads and nuts; except use only hexagonal units for exposed connections.
2. High-Strength Fasteners: Quenched and tempered steel bolts and nuts conforming to requirements of ASTM A325 or A490, or as otherwise noted on Structural Drawings. Provide heavy hexagonal head bolts and nuts and hardened steel washers. Load indicator washers conforming to ASTM F959 or tension control bolts shall be used. All bolts, nuts and washers exposed to the weather shall be hot-dipped galvanized.
3. Drilled-in-Concrete Expansion Anchors: Shall be Hilti concrete anchors as manufactured by Hilti Corporation, or Simpson Strong-Tie, or equal having ICC approval, of the type noted on Structural Drawings.

E. Steel Stud Anchors

1. All steel stud anchors welded to steel beams or embedded items for concrete connections shall be "Nelson Studs" as manufactured by Nelson Stud Welding Division, headed concrete anchors by Welding Products, Inc., or equal. Install as indicated on Drawings, automatically end-welded in shop or field with equipment recommended by manufacturer of studs.

F. Weld Electrodes

1. For base metal conforming with ASTM A36, A53, A500 and A992 Gr50, use E70xx series electrodes in accordance with AWS A5.1 or AWS A5.5.
2. Electrodes for welding A706 rebar shall comply with the filler metal requirements of AWS D1.4, Table 5.1.
3. Weld filler metal for components and connections of the seismic force resisting system shall have a minimum specified yield strength of 70,000 psi and shall conform to the requirements of AWS D1.8 clauses 6.1, 6.2, and 6.3.

G. Zinc Coating

1. All structural steel where noted, shall be galvanized by the "hot-dip" method in accordance with ASTM A123, of the following coating weights per square foot of actual surface:

Steel under 1/16"	:	1.1 oz. average, 1.8 oz. min.
Steel 1/16" to under 1/8"	:	1.5 oz. average, 1.8 oz. min.
Steel 1/8" to under 1/4"	:	2.0 oz. average, 1.8 oz. min.
Steel 1/4" and heavier	:	2.3 oz. average, 2.0 oz. min.

2. Galvanize bolts and similar threaded fasteners in accordance with ASTM A153, Class A, B, C and D, as applicable.
3. Steel pipe shall be galvanized in accordance with ASTM A53.
4. Furnish certificate from plating firm attesting to conformance with Specifications for steel plates and shapes.

H. Shop Painting Materials

1. Galvanized Items: Furnish zinc-rich primer for re-galvanizing welds in galvanized steel, complying with Steel Structures Painting Council (SSPC) Painting System Guide PS12.01.
2. All Other Non-Ferrous Metal Items: Furnish Tnemec Company, Inc. "FD88 Azeron Primer", R.J. McGlennon Co. Inc “42 Series Mactek Low VOC Hight Solids Primer,” or equal. Primer shall be lead-free, high solids modified alkyd primer, meeting or exceeding performance requirements of Federal Specification TT-P-86G, Type I.
3. Portions of items to be embedded in concrete, or at high-strength bolted or welded connections: No shop painting permitted.
4. **All products shall be “0 (Zero) Lead,” utilizing the lead safe work practices identified in the EPA Guidance Document titled “Steps to Lead Safe Renovation, Repair, and Painting, pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

I. Grout For Base & Bearing Plates

1. For general use furnish Sika Chemical Corp. "Sikagrout 212" or Master Builders "Masterflow 928 Grout", or equal, "flowable" consistency, with a minimum compressive strength in 28 days of 7000 psi.

J. Other Materials

1. Provide all incidental and accessory materials, tools, methods, and equipment required for fabrication and erection of structural steel framing as indicated on Drawings.

2.2 FABRICATION

A. GENERAL

1. Fabrication and assembly shall be performed in the shop to the greatest extent possible, all in accordance with the requirements of AISC specifications and in strict accordance with the details shown on the Contract Documents or as accepted on shop drawings. Assemble and weld built-up sections by methods which will produce true alignment of axis without warp.
2. Beams and girders shall be upward cambered where indicated on Drawings. For beams and girders without specified cambers, fabricate members so that after erection, any minor camber due to rolling or fabrication is upward.
3. Identify all steel at mill, showing grade and yield points.
4. Properly mark and match-mark materials for field assembly and for identification as to location for which intended.
5. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
6. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations.
7. Provide finish surfaces of members exposed in the final structure free from markings, burrs, and other defects.

B. STRAIGHTENING MATERIAL

1. If rolled sections are not straight within the tolerances allowed by ASTM A6, straighten by methods not injuring the metal, as approved. Examine all straightened material prior to fabrication for signs of distress or other defects; no distressed or otherwise defective material will be accepted.

C. OPENINGS & HOLES

1. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, only as approved by the Structural Engineer as shown on the Drawings and on the reviewed Shop Drawings.
2. Provide threaded nuts welded to framing, and other specialty items as shown, to receive other work.
3. Cut, drill, or punch holes perpendicular to metal surfaces.
4. Do not flame cut holes or enlarge holes by burning.
5. Drill holes in bearing plates.
6. All holes and openings not indicated on Structural Drawings shall be approved by Structural Engineer.
7. No sharp bends or kinks will be allowed.
8. The Contractor shall include provisions in the bid for holes for sprinkler piping to be placed through steel beams and girders in locations as directed by the Structural Engineer.
9. The Contractor shall verify that the beam web hole layout shown on the plans is compatible with the final sprinkler piping layout prior to fabrication. Any change from the hole layout shown on the plans shall be approved by the Structural Engineer.

D. CONNECTIONS

1. Provide bolts and washers of types and sizes required for completion of field erection. Form connections as detailed; make all shop connections by welding or bolting as approved on shop drawings.
2. High strength bolted construction:

a. Install high strength threaded fasteners in accordance with AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts," using fully pre-tensioned bolts.
b. Use A325-N bolts unless noted otherwise on the Drawings.

3. Welded construction: Comply with AWS Code for procedures, appearance, and quality of welds, and methods used in correcting welded work.
4. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
5. No combination of bolts and welds shall be used for stress transmission in the same faying face of any connection without prior approval by the Structural Engineer.

E. WELDING

1. Conform to Standards No. 1 and No. 2 as applicable. All welding shall be in accordance with the "Structural Welding Code", ANSI/AWS D1.1, and shall be performed by certified welders.
2. Welding processes other than shielded metal arc, submerged arc, and flux cored arc may be used, provided procedure qualification tests in accordance with the AWS are made for the intended application of all such processes.
3. Built-up sections assembled by welding, when present, shall be free of warpage, and all faces shall have true alignment.
4. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS, except make all structural steel welds not less than 3/16 inch, unless noted otherwise. Note on shop drawings when assumption of weld is used for review of conformance.
5. Welding sequences, pre-post-heat methods, and detailing of joints shall be such as to reduce the residual stresses to a minimum.
6. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.
7. Prepare and clean sharp edges to be joined of all oil, grease, scale, and rust in accordance with AWS D1.1.
8. Remove all slab or flux remaining on any bead before proceeding. Remove any cracks or blow holes that appear on any bead by chipping, grinding, or arc-gouging before proceeding.
9. In galvanized steel work, touch-up surfaces damaged by welding with zinc-rich primer complying with SSPC-PS12.01.
10. Welding of architecturally exposed structural steel (AESS) shall conform to the welding requirements for AESS in Standard No. 2. Additionally, welds which are exposed to view in the final building shall be ground smooth to a throat depth not less than specified in the plans and specifications.

F. FINISHING

1. Prepare compression joints depending upon contact bearing to common plane by milling, sawing or approved means.
2. Architecturally exposed structural steel shall be finished to be free from scratches, burrs, rust, pitting and other defects, per the AISC requirements and as directed by the Architect.

G. STEEL STUD & DEFORMED BAR ANCHORS

1. All anchors shall be automatically end-welded in the shop or field with equipment recommended by the manufacturer of the studs and by qualified welders. Steel stud material, welding, and inspection shall be in accordance with AWS D1.1. End-weld in such a manner as to provide complete fusion between the end of the stud and the plate. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate.

H. TOLERANCES, STRAIGHTNESS & LENGTH
1. Conform to Standard No. 1.
2. Fabrication tolerances for architecturally exposed structural steel (AESS) shall conform to the requirements for AESS given in Standard No. 2.

I. SHOP PAINTING

1. Work Not Requiring Shop Painting:
   a. Shop painting not required on steel to be hot-dipped galvanized, encased in concrete or masonry, or covered with spray-applied fireproofing.
   b. Do not shop paint surfaces of steel elements where a field weld or a high-strength bolt connection is to be applied.
2. Surfaces Requiring Shop Painting:
   a. Except for members specified above, all other surfaces shop painted after fabrication, before leaving fabricator's shop.
   b. Paint embedded steel which is partially exposed in the exposed portions, and the initial 2" of embedded areas only.
   c. Shop painting of architecturally exposed structural steel (AESS) shall be per the Architect's requirements for each member.
3. Surface Preparation:
   a. General: After fabrication, clean surfaces free of all mill scale, rust, oil, grease, weld slag, flux deposit, dirt and other foreign matter. Clean and prepare surfaces in exterior work in accordance with SSPC Specification SP6. Clean and prepare surfaces in interior work in accordance with SSPC Specification SP3.
   b. Inaccessible Finished Surfaces: Except for contact surfaces as specified below, surfaces inaccessible after shop assembly shall be cleaned and prime painted as specified herein, prior to assembly. Apply two (2) coats; change color of the second coat to distinguish it from first coat.
   c. Contact Finished Surfaces: Conform to Standard No. 1; clean and prepare surfaces in accordance with SSPC standards SP1 and SP3.
   d. Surfaces Adjacent To Field Welds: Conform to Standard No. 1.
4. Shop Painting, Material and Application: Paint with one coat of primer specified above, except two (2) coats at inaccessible finished surfaces, by brush, spray, roller coating, flow coating or dipping at Contractor's option, applied to an even consistency to provide a uniform dry film thickness of not less than 1.5 mils per coat. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer.
5. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated. **In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in theEPA Guidance Document titled "Steps to Lead Safe Renovation, Repair, and Painting," pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior Work

1. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
2. In the event of discrepancy, immediately notify the Architect.
3. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 STRUCTURAL METAL ERECTION

A. General

1. Comply with AISC specifications and "Code of Standard Practice," except as may be modified herein. Coordinate as required with other trades to assure proper and adequate provisions in the work of those trades for interface with the work of this Section. Exercise care to prevent damage due to handling, dropping or placement of members.
2. Furnish anchor bolts and templates, and other items as indicated, to other Sections for installation prior to placement of concrete.
3. Install the work of this Section in strict accordance with the original design, the approved shop drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturers recommended installation procedures as approved by the Architect.
4. Install in accurate locations and to lines and elevations indicated. Align and adjust members forming part of a complete frame or structure before fastening permanently. Adjust and shim as required to compensate for discrepancies in elevation and alignment. Level and plumb individual members of the structure within AISC tolerances; final assembly shall produce true alignment of axis without warp.
5. Erection of architecturally exposed structural steel (AESS) shall meet the require,ents given for AESS in Standard No. 2. AESS shall be unloaded, handled, and erected to avoid marking or distorting members.
6. Weld, securely anchor and install bracing and/or bridging before applying any loads, except the weight of the erectors. Anchor all components firmly into position for long life under hard use.
7. Tighten and leave erection bolts in place after welding. Where high-strength bolts are required, provide identified and marked bolts. Install using procedure as hereinafter specified; mark tightened bolts.
8. Drift pins shall not be used to enlarge unfair holes in main material. Holes that must be enlarged shall be reamed up to a maximum of 1/16th of an inch larger to admit bolts. Burning, drifting and reaming may be used to align unfair holes in members only after approval by the Owner’s independent testing agency.
9. Furnish shim plates or develop fills where required to obtain proper fit and alignment.
10. Mutilate threads or use lock nuts for unfinished bolts to prevent nuts from backing off. Draw unfinished bolt heads and nuts tight against the work.
11. Temporary erection angles and tack welds may be used to provide temporary support for architecturally exposed structural steel during erection. Temporary angles shall be removed and tack welds ground smooth after member is secured.

B. Anchor Bolts

1. Provide anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
2. Provide templates and other devices necessary for presetting bolts and anchors to accurate locations.

C. Bases and Bearing Plates: Shop weld to columns and members attached to concrete.

D. Splicing

1. Splice members only where indicated unless, with the Architect's approval, splices not indicated would result in lower costs due to reduced shipping expense.
2. For splices not indicated, submit structural calculations prepared and signed by a structural engineer licensed to practice in the State of Nevada.
3. Fasten splices of compression members after bringing abutting surfaces completely into contact. Make all field connections by high-strength bolting or welding, unless otherwise noted.

E. Gas Cutting

1. Do not use gas cutting torches for correcting fabricating errors in the structural framing.
2. Cutting will be permitted only in secondary members as acceptable to the Architect.
3. When gas cutting is permitted, finish the gas cut section to a sheared appearance acceptable to the Architect.

F. Surveys

1. Establish permanent benchmarks necessary for accurate erection of structural steel.
2. Check elevations of concrete surfaces, and locations of anchor bolts and similar items, before erection proceeds.
3. Submit erection survey data to the Architect for review; to validate plumbness of the structural steel frame and to verify compliance with AISC erection tolerances.

G. Temporary Shoring and Bracing

1. Conform to Standard Nos. 1 and 2, as applicable.
2. Temporary bracing and guys shall be introduced wherever necessary to provide for loads and stresses to which the structure may be subjected, including those due to erection equipment and their operation and shall be left in place as long as it may be necessary for safeguarding all parts of the work.
3. Provide supplemental structural steel support framing for metal decking where deck bearing is precluded by column flange plates or other framing members. Remove temporary connections and members when permanent members are in place and the final connections have been made.

H. Setting Bases and Bearing Plates

1. Clean concrete bearing surfaces free from bond-reducing materials, and then roughen to improve bond to the surface.
2. Clean the bottom surface of base and bearing plates.
3. Set loose and attached base plates and bearing plates for structural members in wedges or other adjusting devices.
4. Tighten anchor bolts after the supported members have been positioned and plumbed.
5. Do not remove wedges or shims but, if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
6. Pack grout solidly between bearing surfaces and bases or plates to assure that no voids remain.
7. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's recommendations as approved by the Architect.

I. Field Assembly

1. Set structural frames accurately to the lines and elevations indicated.
2. Align and adjust members forming part of a complete frame or structure before fastening permanently.
3. Clean the bearing surface, and other surfaces which will be in permanent contact, before assembly.
4. Adjust as required to compensate for discrepancies in elevation and alignment.
5. Level and plumb individual members of the structure within specified AISC tolerances.
6. Establish required leveling and plumbing measurements on the mean operating temperature of the structure, making allowances for the difference between temperature at time of erection and the mean temperature at which the structure will be when completed and in service.
7. Comply with AISC specifications for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to welds.

3.3 TESTING AND INSPECTING

A. Testing

1. Costs of tests of identified stock will be paid by the Owner; except that if a test fails to comply with the specified requirements, the cost of testing will be paid by the Owner and back charged to the Contractor.
2. Costs of tests of unidentified stock will be paid by the Owner and back charged to the Contractor.
3. Test of mill order steel: Where structural steel, ordered from the mill and cut to lengths, is identified by heat or melt numbers and is accompanied by mill analysis or test reports, such material shall be used without further local test, provided an affidavit is given that the materials conform with the requirements of these Specifications. In case of controversy, tension and bend tests of the material either locally or at the mill, as required for local stock will be required.
4. Tests of unidentified steel: Where steel cannot be identified or its source is questionable, have one set of physical tests made for each 5 tons, or fraction thereof, for each size member and appropriately mark the steel to identify it with the test specimen. Have testing laboratory check the stock, select and mark test specimens, and make the required laboratory tests. Miscellaneous steel items such as angle clips, anchors and inserts need not be tested when Contractor submits written warranty as to their quality. Test reports shall be acceptable to the Architect prior to fabrication.
5. Additional tests may be required when deemed necessary by the Architect.

B. Inspecting

1. A complete four sided inspection of steel will be made when required by the Architect.
2. Cost of inspecting will be paid by the Owner subject to the same provisions made above for tests.
3. If, after fabrication and inspection, the work of this Section is found to be defective and to require reinspection, cost of such reinspection will be paid by the Owner and back charged to the Contractor.
4. Provide labor, equipment, and facilities needed to move and handle the materials to be inspected.

C. Welding Inspection

1. Unless otherwise specified, perform welding under observation of a qualified inspector from a testing laboratory approved by the Architect.
2. Inspect every layer of weld for quality, penetration, and conformity with design requirements.
3. Require the welding inspector to submit a signed report to the Architect, verifying that:
   a. The welding is adequate and was performed in conformity with the specified requirements; and
   b. Adequate methods have been used to determine the quality of the welding.
4. The welding inspector may use gamma ray, magnaflux, trepanning, or any other aid to visual inspection considered necessary to assure adequacy of welding or may use ultrasonic testing performed in accordance with pertinent requirements of governmental agencies having jurisdiction.
5. Cost of initial welding inspection will be paid by the Owner. If the welds fail the inspection, the cost of additional welding inspection will be paid by the Contractor.

D. Access

1. Provide access for the testing agencies and inspectors to places where structural steel work is being fabricated or produced, so that required testing and inspecting may be accomplished.

E. Erection Inspection

1. The Owner's testing and inspecting agency will inspect field welded connections, will perform such additional tests and inspections of field work as are required by the Architect, and will prepare test reports for the Architect review.
2. The testing agency will conduct and interpret the tests and will state in each report whether the inspected work complies with the requirements, specifically stating all deviations therefrom.

F. Corrections

1. Correct deficiencies in structural steel work which inspections and test reports indicate to be not in compliance with the specified requirements.
2. Perform additional tests required to reconfirm noncompliance of the original work and to show compliance of corrected work, all at no additional cost to the Owner.

3.4 FIELD PAINTING & FINAL CLEANING

A. Field Painting

1. General
   a. All bare steel surfaces and welds, except those to receive other coatings, which remain after installation shall be field painted at all locations both exposed and concealed in the finished Work.
   b. Prepare surface in a manner appropriate to the condition, and as approved by the Architect.
   c. Clean spots and surfaces where primer coats have been removed, damaged, or burned off, and clean field bolts and other field connections.
   d. Remove dirt, oil, and grease.
   e. Apply one spot coat of the approved primer.
   f. Do not apply paint to wet, damp, oily, or improperly prepared surfaces.
2. Application – Notify the Architect when the work of this Section is ready to receive field painting.
   a. Secure inspection and approval by the Architect prior to field painting.
   b. Using spray or brush, as recommended by the manufacturer of the approved paint material, fill all joints and corners and cover the surfaces with a smooth unbroken film of at least 1.5 dry mils thickness, for each of the two required coats.
   c. Comply with manufacturer’s written instructions and recommendations in “MPI Architectural Painting Specification Manual” applicable to substrates indicated. **In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in theEPA Guidance Document titled “Steps to Lead Safe Renovation, Repair, and Painting,” pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

B. Final Cleaning

1. As erection on each floor or area is completed, steel surfaces to receive sprayed-on fireproofing shall be left clean as previously specified.

END OF SECTION 05 10 00

SECTION 05 20 00 - METAL JOISTS

PART 1 – GENERAL

1.1 SUMMARY

A. Provide metal joist system, complete with accessories, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 05 10 00: Structural Steel.
3. Section 05 31 00: Steel Deck.

1.2 SUBMITTALS

A. Submit:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
3. Shop Drawings showing sizes, spacing, and location of joists, connections, bridging, reinforcing, anchoring, cambers, loads, and other pertinent data, and showing welded connections and the length thereof, using AWS standard welding symbols. Open web joist calculations prepared and stamped by a licensed Nevada Civil or Structural Engineer shall be submitted as a part of the open web joist shop drawing package.
4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
5. For splices not indicated, submit structural details and calculations prepared and signed by a structural engineer licensed to practice in the State of Nevada.
6. At completion of manufacturing, the steel joist manufacturer shall submit a Certificate of Compliance in accordance with Section 1704.2.5.1 of the 2018 IBC stating that work was performed in accordance with the approved construction documents and with SJI Standard Specifications.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. In addition to complying with pertinent requirements of governmental agencies having jurisdiction, comply with the "Standard Load Tables" and pertinent standard specifications of the Steel Joist Institute.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide steel joists and accessories system in dimensions and arrangements shown on the Drawings, as manufactured by the following, or equal:

1. Vulcraft
2. New Millenium

2.2 FABRICATION

A. Fabricate the steel joists system in strict accordance with the approved Shop Drawings and the requirements of governmental agencies having jurisdiction, and in accordance with the following as pertinent:

1. Verify dimensions prior to fabrication.
2. Provide top and bottom joist chord extensions where indicated on the Drawings or otherwise required:
3. Camber joists to accommodate dead load deflection.

B. Except where galvanizing or spray applied fireproofing may be called for on the Drawings, or the approved Shop Drawings, shop-prime the joist system using one coat of "10-99 Tnemec Primer," "Rustoleum No. 5769 Primer," or equal, to a dry film thickness between 2.0 and 3.5 mils. At joists which will be exposed in the final construction, special care shall be provided in during the shop-prime painting of the joist system as needed to provide a smooth uniform coating that is acceptable to the Architect.

C. **All products shall be "0 (Zero) Lead," utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair, and Painting, pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use.

C. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated. **In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in the EPA**

Guidance Document titled "Steps to Lead Safe Renovation, Repair, and Painting," pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.

END OF SECTION 05 20 00

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.

B. Related Requirements:

1. Division 03 Section "Cast-in-Place Concrete" for lightweight structural concrete fill over steel deck.
2. Division 05 Section “Steel Joists” for open-web steel joist framing.
3. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
4. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
5.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Welding certificates.

D. Product Certificates: For each type of steel deck.

E. Evaluation Reports: For steel deck.

F. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASC Profiles, Inc..
2. Nucor Corp.; Vulcraft Group.
3. Verco Manufacturing Co.
4. EPIC Metals Corporation
5. New Millennium Systems

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Steel Sheet:
   a. ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating U.N.O.
   b. Architecturally Exposed Metal Deck: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60 zinc coating.
2. Prime painting: As indicated.
3. Deck Profile: As indicated.
4. Profile Depth: As indicated.
5. Design Uncoated-Steel Thickness: As indicated.

6. Span Condition: Double span or more wherever possible.
7. Side Laps: As required for specified connections.
8. Acoustic Deck: Where acoustic deck is indicated, provide deck with acoustic perforations and acoustic insulation elements.
9. All composite roof deck shall be unvented.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

D. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

F. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck. Conform to typical details provided or submit alternates for review and approval.

G. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

I. Galvanizing Repair Paint: ASTM A 780.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners shall be used where specified on the Drawings but may not be used in lieu of welding where welding is specified.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members as specified on the drawings with mechanical fasteners, power-actuated fasteners, arc spot (puddle) welds of the surface diameter indicated, or arc seam welds as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Fastener Size: As indicated.
3. Weld/Fastener Spacing: As indicated.

B. Side-Lap Fastening: As specified on the Drawings. Mechanically clinch or use mechanical fasteners to fasten side laps between supports as indicated.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing and non-load bearing light gauge steel wall framing.
2. Exterior light gauge steel roof (joist) framing
3. Exterior light gauge steel soffit framing.
4. Interior light gauge steel framing where indicated.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications."
2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

C. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Studco Building Systems.
2. ClarkDietrich Building Systems.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H, ST50H
2. Coating: G60.

2.3 EXTERIOR LOAD-BEARING AND NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated.
2. Flange Width: As indicated.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated.
2. Flange Width: As indicated.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: As indicated.
2. Flange Width: As indicated.

2.4 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated.
2. Flange Width: As indicated.

B. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section joist track, with unstiffened flanges; unpunched; of web depths indicated; and as follows:

1. Minimum Base-Metal Thickness: As indicated.
2. Flange Width: As indicated.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As indicated.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced 48 inches. Fasten at each stud intersection.

1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single-leg deflection tracks and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   a. Install solid blocking at 96-inch centers.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: As indicated.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated.

1. Install web stiffeners to transfer axial loads of walls above.

F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Drawings and general provisions of the Contract Documents including General, Supplemental and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. The extent of the miscellaneous metal work is indicated on the drawings, which includes, whether specified herein or not, all items fabricated from iron and steel shapes, plates, bars, strips and pipes which are not a part of structural steel or other metal systems in other sections of these specifications.

C. Related Sections

1. Division 3 Section “Cast-in-Place Concrete” for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
2. Division 4 Section “Concrete Unit Masonry” for installing loose lintels, anchor bolts, and other items indicated to be built into masonry.
3. Division 5 Section “Structural Steel”
4. Division 5 Section “Steel Joists”
5. Division 5 Section “Steel Decking”
6. Coordinate with all applicable sections of these specifications for related work where miscellaneous metals work is to be used.

1.2 QUALITY ASSURANCE

A. Standard Specifications: Comply with the provisions of the following codes, standards and specifications, except as otherwise shown or specified:

1. AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings”, and including “Commentary of the AISC Specifications”.
2. AISC “Specification for the Design of Cold-Formed Steel Structural Members”.
3. AWS “Structural Welding Code”.

B. Qualifications for Welding Work

1. Qualify welding processes and welding operators in accordance with the AWS “Standard Qualification Procedure”.

1.3 SUBMITTALS

A. Manufacturer’s Data

1. Submit manufacturer’s specifications, dimension diagrams, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work, including paint products.

B. Shop Drawings

1. Submit **complete**, checked shop drawings.
2. Include shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work, which are not completely shown by the manufacturer's data sheets.
3. Include all details, elevations, welding and other connections, zinc-coating and shop painting information and dimensions; coordinate with connecting and adjacent work; show anchorage and accessory items.
4. Include plans and elevations at not less than 1" to 1'-0" scale and include details of sections and connections at not less than 3" to 1'-0" scale.
5. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by other trades.
6. Shop drawings are interpretations of and are supplemental to the design drawings and specifications. Their intent is to demonstrate to Architect that this Contractor has understood the design concept, and to provide detailed information necessary for the fabrication, assembly, and installation of the products and materials specified. Neither the shop drawings nor comments placed on them by the Architect shall be construed as being change orders.

1.4 JOB CONDITIONS

A. Field Measurements

1. Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

B. Inserts & Anchorages

1. Furnish inserts and anchoring devices which must be set in concrete and/or welded to building components for the installation of miscellaneous metal work. Coordinate delivery with other work to avoid delay.

C. Shop Assembly

1. Pre-assemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site.
2. Disassemble units only to the extent necessary for shipping and handling limitations.
3. Clearly mark units for re-assembly and coordinated installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials – General

1. Metal Surfaces, General: For the fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coatings.
2. Steel Plates, Shapes and Bars: ASTM A36.
3. Steel Plates to be Bent or Cold-Formed: ASTM A283, Grade C.
4. Cold-Finished Steel Bars: ASTM A108, grade as selected by fabricator.

5. Hot-Rolled Carbon Steel Sheets and Strips: ASTM A568 and ASTM A569; pickled and oiled.
6. Cold-Rolled Carbon Steel Sheets: ASTM A 366.
7. Galvanized Carbon Steel Sheets: ASTM A653, with hot-dip galvanized coat complying with ASTM A924, G90.
8. Steel Pipe: ASTM A53, type as selected; Grade A; black finish; standard weight (schedule 40), except where otherwise shown or specified as stronger.
9. Steel Tubing: ASTM A500, Grade C, Grade 50.
10. Stainless Steel: Type 304, ASTM A167, with AISI 2D finish, deal soft, fully annealed.
11. Aluminum: Furnish extruded shapes of 6061-T6 alloy, of gauges, shapes and sizes required, unless otherwise specifically specified herein.

B. Anchors

1. Threaded-Type Concrete Inserts: Galvanized ferrous castings, internally threaded to receive machine bolts; malleable iron ASTM A27; hot-dip galvanized.
2. Wedge-Type Concrete Inserts: Box-type ferrous castings, designed to accept bolts having special wedge-shaped heads; malleable iron ASTM A47, or cast steel ASTM A27; hot-dip galvanized.
3. Slotted-Type Concrete Inserts: 1/8" thick pressed steel plate, ASTM A283; box-type welded construction with slot design to receive square head bolt and with knockout cover; hot-dip galvanized.

C. Fasteners

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls.
2. Standard Bolts and Nuts: ASTM A307, Grade A, regular hexagon head.
3. Lag Bolts: Hex head type complying with Federal Spec FF-B-561.
4. Machine Screws: Cadmium plated steel complying with Federal Spec FF-S-111.
5. Plain Washers: Round, general assembly grade carbon steel complying with Federal Spec FF-W-92.
6. Lock Washers: Helical spring type carbon steel complying with Federal Spec FF-W-84.

D. Zinc Coating

1. Except as further specified below, where noted in this Section that ferrous metal items are to be zinc-coated or galvanized, provide by the "hot-dip" method, in accordance with ASTM A123, of the following coating weight per square foot of actual surface:
   Steel under 1/16" : 1.1 oz. average, 1.8 oz. min.
   Steel 1/16" to under 1/8": 1.5 oz. average, 1.8 oz. min.
   Steel 1/8" to under 1/4" : 2.0 oz. average, 1.8 oz. min.
   Steel 1/4" and heavier : 2.3 oz. average, 2.0 oz. min.
2. Galvanize bolts and similar threaded fasteners in accordance with ASTM A153, Class A, B, C and D, as applicable.
3. Steel pipe shall be galvanized in accordance with ASTM A53.
4. Steel sheet in coils and cut lengths shall be galvanized in accordance with ASTM A924, G-60 or G-90 specifications, as applicable.
5. Furnish certificate from plating firm attesting to conformance with Specifications for steel plates and shapes.

E. Metal Primer Paint

1. Zinc-Coated (Galvanized) Material: Not required, except furnish zinc-rich primer for re-galvanizing welds in galvanized steel, complying with Steel Structures Painting Council (SSPC) Painting System Guide PS12.01.
2. All Other Ferrous Metals - Concealed in the Completed Work: Furnish Tnemec Company, Inc. "FD88 Azeron Primer", or approved equal, lead-free, high solids primer, meeting or exceeding performance requirements of Federal Specification TT-P-86G,

Type I. At fabricator's option, primer as specified below for 'exposed' applications may be used for 'concealed' work.

3. All Other Ferrous Metals - Exposed in the Completed Work: Furnish Tnemec "Series 37 Chem-Prime" or Sherwin Williams "Kem Kromik Universal Metal Primer", or equal, chromate-free rust inhibitive universal alkyd-phenolic primer compatible with high performance primer and finish coats as specified.
4. **All products shall be "0 (Zero) Lead," utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair, and Painting, pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

F. Grout for Installation of Metal Fabrication

1. For general use, furnish Master Builders "Masterflow 928 Grout", "Euco N-S" (non-metallic) by the Euclid Chemical Company, or equal, "flowable" consistency, with a minimum compressive strength in 28 days of 7000 psi.

2.2 FABRICATION - GENERAL

A. General

1. Use materials of the size and thicknesses shown or, if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of the work.
2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work; punch and shear leaving clean and true surfaces.
3. Weld corners and seams continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.
4. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown or, if not shown, use Phillips flathead (countersunk) screws or bolts.
5. Provide holes, cuts and connections, where shown, for work of other trades. Provide for anchorage of the type shown, coordinated with the supporting structure and the progress schedule. Fabricate and space anchoring devices as shown and as required to provide adequate support for the intended use of the work.
6. Use hot-rolled steel bars for work fabricated from bar stock, unless work is indicated to be fabricated from cold-finished or cold-rolled stock.
7. Detail joints and fastenings for ample strength and stiffness as shown or approved; conceal fastenings wherever possible.
8. Form joints to exclude water, where exposed to elements.

B. Shop Painting

1. Zinc-coated (galvanized) material: Where required on plans.
2. All other ferrous metals:
   a. Remove all mill scale, rust, loose rust, oil, grease, dirt and foreign matter. Clean and prepare surfaces in exterior work in accordance with SSPC Specification SP6. Clean and prepare surfaces in interior work in accordance with SSPC Specification SP3.

b. Apply one brush or airless spray coat primer coating of applicable type as specified above, as applicable, applied to all exposed surfaces after fabrication, dry film thickness as specified above.

3. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated. **In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair, and Painting," pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

2.2 FABRICATION – MISCELLANEOUS STEEL ITEMS

A. Railings, Handrails & Guardrails

1. General:
   a. Fabricate from ASTM A53 schedule 40 "standard" steel pipe and ASTM A36 steel plate, bar, rod and angle members of sizes and configurations shown for the various exterior and interior conditions and applications, all joints welded and ground smooth.
   b. Fabricate guardrails, railings and handrails accurately, level with finish floor or sloped to match angle of stair and ramp construction, as applicable. Radius steel pipe handrails and railings at corners and ends as shown.
   c. Jointing of posts, rail and corners, except radiused corners, shall be by mitered and welded joints made by fitting vertical posts to top rail and intermediate rails to vertical posts, mitering corners, except radiused corners, groove welding joints, and grinding smooth. Radiused corners shall be bent to shapes indicated, with bends made in a suitable jig such that pipe is not crushed.
   d. Exposed ends of rails, closed, welded and welds ground smooth.
   e. Vertical members of railings one piece to underside of top rail.
   f. After fabrication, galvanize exterior members, where so indicated by the Architect.
2. Pipe Sleeves for Vertical Members Set in Concrete: Fabricate from galvanized steel pipe to size shown, for recessed installation in concrete.
3. Pipe Plate Supports for Vertical Members Set on Steel Framing: Fabricate from steel plate to size and shape shown, complete with threaded studs with bolts welded to bottom side, for securing to steel framing.
4. Pipe Plate Supports for Vertical Members Returns at CMU Walls: Fabricate integral with railing supports from steel plate to size and shape shown, welded to railing returns, complete with holes for threaded anchor bolts set in masonry wall.
5. Handrail Brackets: For handrails mounted to steel framing, concrete or masonry wall construction, provide of radiused 3/4-inch round steel rod, formed to size and shape as detailed, complete with steel plate mounting flange.

B. Steel Sign Posts

1. Provide of 6 inch diameter ASTM A53 schedule 40 steel pipe together with 4x4 inch tube steel, lengths as required for mounting handicap and other various traffic control signs to heights above grade as indicated on Civil Drawings.
2. Drill holes of size and in locations required for signs as indicated, ready for installation of signs.
3. Furnish complete with welded cap plate as shown.
4. Galvanize steel pipe and tube steel post members inside and out after fabrication.

C. Fixed and Removable Steel Pipe Bollards

1. Provide ASTM A53 schedule 40 steel pipe, diameter and length as required for conditions shown.

2. Unless otherwise shown, bollards shall extend 3'-6" above adjacent finish grade and set in concrete footing as detailed and specified below.

D. Roof Access Ladders

1. Fabricate accurately of mild steel flat bars and rods as detailed, all joints welded and ground smooth, of sizes, lengths and configurations shown or otherwise required for roof access and elevator pit access locations.
2. Unless otherwise shown on Drawings, vertical members and bent flat bar support bracket members 3/8 x 2 inch material; vertical members spaced apart as shown on applicable details; support bracket spaced as shown.
3. Rungs: 1 inch square bars, unless otherwise shown, spaced on 12 inch centers, mortised into vertical members and welded.
4. Siderails shall be spaced 16" apart, unless otherwise noted.
5. Support to walls shall be provided at top and bottom and not more than 60" o.c. with welded or bolted steel brackets.
6. Prime paint steel members after fabrication.

E. Louver Frame Stops

1. Fabricate from ASTM A36 steel angle and flat bar members of sizes and to configurations shown or otherwise required for each wall louver opening, with all connections fully welded and ground smooth; refer to applicable details in Project Manual Volume II, plus related drawings and details.
2. Drill holes of size and in locations required for bolted connections and for securement of louvers.
3. All steel members galvanized after fabrication.

F. Other Items

1. Furnish all other miscellaneous metal fabrication items shown on Drawings and not classed as structural steel. Generally this includes steel angle jamb supports for overhead coiling door and shutter guides, and the like. Fabricate accurately.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete construction. Coordinate the delivery of such items to the project site.

3.2 SURFACE CONDITIONS

A. Prior to installation of work in this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where installation of the work of this Section may properly commence

B. Verify that miscellaneous metal items have been fabricated for installation in strict accordance with the original design and the approved shop drawings.

C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation of miscellaneous metal items in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 MANUFACTURED ITEMS

A. Immediately after erection, clean the field welds, bolted connections, and abraded areas of shop rimming. Paint the exposed areas with same material used for shop priming, to the same required thickness.

3.4 INSTALLATION – FABRICATED ITEMS

A. Installation - General

1. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal item to in-place construction; including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.
2. Cutting, fitting & placement:
    a. Perform all cutting, drilling, and fitting required for installation of the miscellaneous metal items. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
    b. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
    c. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
    d. Grind joint smooth and touch-up shop paint coat.
    e. Do not weld, cut or abrade the surfaces of units which have been hot-dip galvanized after fabrication, and are intended for bolted field connections.

B. Guardrails, Railings & Handrails

1. Erect guardrails, railings, and handrails as detailed and shown on Drawings and applicable Details for the various construction types and conditions, in all locations shown on Drawings, true to line.
2. Set vertical members into pipe sleeves where set in concrete, secured with metal wedges and grout with "Por-Rok" or approved non-shrink grout; slope top of grout to drain away from pipe support.
3. Secure guardrails and stair handrails and railings with brackets secured to wall construction as shown for the various conditions.
4. Fully weld vertical members to steel edgings and stringer supports as shown and otherwise required for metal structures.

C. Steel Sign Posts

1. Install sign posts at the various site locations as shown and directed by Architect, set in concrete and conforming to the following requirements:
    a. Do not set posts prior to completion of final grading.
    b. Drill holes for post footings in firm, undisturbed or compacted soil.
    c. Place concrete around posts in a continuous pour, tamp for consolidation.
    d. Check each post for vertical and top alignment.

D. Steel Angle Edgings at Interior Concrete Floor Edges

1. Install as detailed and otherwise required for the conditions of the work, securely anchored to concrete floor construction as shown; coordinate with cast-in-place concrete work specified under Section 033000.

E. Roof Access Ladders

1. Install at all ladder locations shown at exterior roof access locations, securely anchored to wall and/or floor construction as required.

F. Louver Frame Stops

1. Install louver frame stops plumb, true to line, bolted to adjacent construction as shown or otherwise required for supporting wall louvers in each applicable condition; coordinate installation with light gauge metal framing work specified under Section 054000 and louver installation.

G. Other Fabricated Items

1. Install all other steel items as specified above and as otherwise shown on Drawings and not classed as structural steel.
2. Install as detailed or required for rigidity and permanence.
3. Grind all welds smooth in fabrication work to be left exposed in completed work.

H. Touch-Up Painting

1. Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal items are specified in Division 9 of these specifications.

END OF SECTION 05 50 00

SECTION 05 51 33 - ALUMINUM LADDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum Ships Ladders

1.2 RELATED SECTIONS

A. Division 7 Section - “Polyvinyl-Chloride (PVC) Roofing”.

1.3 APPLCABLE STANDARDS

A. American National Standards Institute (ANSI) - ANSI A14.3 American National Standard for Ladders - Fixed - Safety Requirements

1.4 SUBMITTALS

A. Product Data: Manufacturer’s data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Coordinate with Roofing Installer and Roofing Manufacturer with installation details that meet roof warranty requirements at roof crossover ladders.

B. Shop Drawings for Ladders:

1. Plan and section of ladder installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store ladder until installation inside under cover. If stored outside, under a tarp or suitable cover.

1.6 WARRANTY

A. Limited Warranty: Five year against defective material and workmanship, covering parts only, no labor or freight. Defective parts, if deemed so by the manufacturer, will be replaced at no charge, freight excluded, upon inspection at manufacturer's plant which warrants the same.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ALACO Ladder Co.

2. Precision Ladders, LLC.

3. Wildeck, Holden Industries Inc.

4. O'Keeffe's Inc.

B. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 ROOF HATCH ACCESS ALUMINUM SHIPS LADDER

A. Aluminum Ships Ladder and Components: Ladder, mounting brackets and handrails on both sides.

1. Capacity: Unit shall support a 500 lb. total load without failure.
2. Width: 24".
3. Length: As indicated on Drawings.
4. Treads: 4 1/4" wide mounted at 12" centers.
5. Ladder Stringer: 5 inches by 2 inches by 3/16 inch extruded 6061-T6 aluminum channel. Pitch: 70 degrees.
6. Ladder Mounting Brackets:

    a. Floor Bracket: 2 inches by 3 inches by 1/4-inch aluminum angle.
    b. Top Bracket: 4-3/4 inch by 5 inches by 1/4-inch aluminum angle.

7. Handrails: 1-1/4 inches Schedule 40, 6061-T6 aluminum pipe provided with cast aluminum fittings.

2.3 FABRICATION

A. Completely fabricate ladder ready for installation before shipment to the site.

B. Completely fabricate handrail components ready for field assembly to ladder before shipment to site.

2.4 FINISHES

A. Manufacturer's standard mill finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Coordinate with Roofing Installer and Roofing Manufacturer with installation details that meet roof warranty requirements.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 05 51 33

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Parapet sheathing.
3. Subflooring at Mezzanine above Custodial S108

B. Related Requirements:

1. Section 07 42 14 - "Formed Metal Wall Panels " for weather barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corporation
b. National Gypsum Company
c. USG Corporation

2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: 48 by 120 inches for vertical installation.
4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.3 PARAPET SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Georgia-Pacific Gypsum LLC; DensDeck Prime
b. National Gypsum Company; Gold Bond eXP Sheathing
c. USG Corporation; USG Securock Brand Gypsum Fiber Board
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Type and Thickness: Regular, 1/2 inch thick.
3. Size: 48 by 96 inches for vertical installation.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Screws for Fastening Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing from 0.033 to 0.112-inch-thick, use screws that comply with ASTM C 954.

2.5 SUBFLOORING

A. Structural Concrete Panel, noncombustible structural subfloor panel.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. USG Corporation; USG Structural Panel Concrete Subfloor
b. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Panel Dimensions:

a. Thickness: 3/4 inches.
b. Width: 48 inches.
c. Lengths: 8 feet.
d. Edges: Tongue and Groove

3. Panel Properties:

a. Moment Capacity: 1585 lb-in/ft (588 N-m/m) tested in accordance with ASTM C1185, Sec.5
b. Bending Stiffness: 315,000 lb-in2/ft (3 kN-m2/m) tested in accordance with ASTM C1185, Sec.5
c. Density: 75 lb./ft3 (1200 kg/m3) tested in accordance with ASTM C1185
d. Weight: 5.0 lbs./ft2 (24.4 kg/m2) tested in accordance with ASTM D1037 at a thickness of 3/4 inch (19 mm)
e. Noncombustibility: Pass tested in accordance with ASTM E136-12
f. Surface Burning Characteristics: 0 – Flame Spread / 0 Smoke Developed tested in accordance with ASTM E84
g. Mold Resistance: 10 tested in accordance with ASTM D3273 0 tested in accordance with G21

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Coordinate wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

END OF SECTION 06 16 00

SECTION 06 41 16 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Plastic-laminate cabinets.
2. Plastic-laminate/wood sink cabinets (see Drawings for construction details).

B. Related Sections:

1. Section 09 93 00 - “Staining and Transparent Finishing” for coating exposed wood cleats and supports beneath countertops.
2. Section 12 36 61 - “Solid Surfacing Countertops” for countertops installed on cabinets and for integral solid surface classroom sinks.

1.3 DEFINITIOS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For panel products high-pressure decorative laminate adhesive for bonding plastic laminate solid-surfacing material cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for plumbing fixtures faucets soap dispensers and other items installed in architectural woodwork.

C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.
3. Thermoset decorative panels.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Woodwork manufacturer with not less than 5 years of production experience similar to this Project, whose qualifications indicate the ability to comply with the requirements of this section.

B. Quality Standard: Unless otherwise indicated, comply with Architectural Woodwork Standards", Edition 1 for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article A.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Softwood Plywood: DOC PS 1, Medium Density Overlay.

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi exposed edges.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

C. Wire Pulls: Back mounted, solid metal, 5 inches long, 2-1/2 inches deep, and 5/16 inch in diameter.

D. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

E. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension full-overtravel-extension type; zinc-plated steel ball-bearing slides.

F. Door Locks: BHMA A156.11, E07121. Provide Door locks in the following locations:

1. Clinic A103: 1 pair upper cabinet doors. This lock shall be keyed differently than all other cabinet/drawer locks.
2. Workroom A117: 1 pair of base cabinet doors.
3. Music Room A135: 5 locks (one at each pair of tall cabinet doors).
4. PTA Kitchen B109: 1 pair upper cabinet doors. This lock shall be keyed differently than all other cabinet/drawer locks.

G. Drawer Locks: BHMA A156.11, E07041. Provide drawer locks in the following locations:

1. Clinic A103: Upper drawer of base unit.
2. Workroom A117: Upper drawer of one base unit.

H. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets, and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "OG series" by Doug Mockett & Company, Inc.

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.

D. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.5 PLASTIC-LAMINATE CABINETS

A. Architectural Woodwork Standards Construction Style A, Frameless, Construction type I, multiple self-supporting units.

B. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.

C. All surfaces exposed to view shall receive Laminate Cladding.

D. Materials for Semi exposed Surfaces: Low-pressure melamine overlay.

E. Doors, drawer fronts, and false fronts shall be flush overlay.

F. Edge band at doors, drawer fronts, and false fronts shall be 3.0 mm thick PVC matching laminate in color, pattern, and finish.

G. Drawers:

1. Sides shall be particle board with melamine faces.
2. Bottoms shall be hardwood plywood.

H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Wilsonart Laminate: 7909-60 ‘Fusion Maple’

2.6 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

2.7 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk, and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

2.8 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 41 16

SECTION 07 19 00 - WATER REPELLENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:

1. Cast-in-place concrete – exterior
2. Concrete unit masonry - exterior.

B. Related Requirements:

1. Section 04 20 00 - "Concrete Unit Masonry" for surface-applied penetrating water-repellent for unit masonry assemblies with exterior exposure.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's standard colors.
3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

B. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of water repellent.

B. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Mockups: Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Locate mockups in locations that enable viewing under same conditions as the completed Work.

a. Size: 25 sq. ft. each.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Building has been closed in for not less than 30 days before treating wall assemblies.
3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F
5. Rain or snow is not predicted within 24 hours.
6. Not less than 24 hours have passed since surfaces were last wet.
7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance: Water repellents shall meet the following performance requirements as determined by testing on manufacturer's standard substrates representing those indicated for this Project.

B. Water Absorption: Minimum 80 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:

1. Cast-in-Place Concrete: ASTM C642.
2. Concrete Masonry Units: ASTM C140.

C. Water-Vapor Transmission: Comply with one or both of the following:

1. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E96/E96M.
2. Minimum 80 percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D1653.

D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E514/E514M.

E. Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G154 compared to water-repellent-treated specimens before weathering.

F. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.

1. Reduction of Water Absorption: 80 percent.
2. Reduction in Chloride Content: 80 percent.

2.2 PENETRATING WATER REPELLENTS

A. Siloxane, Penetrating Water Repellent: Clear, containing 10 percent or more solids of oligomerous alkylalkoxysiloxanes; with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Euclid Chemical Company 'Weather-Guard'.
b. Sure Klean; Weather Seal Siloxane or Weather Seal Siloxane WB.
c. Hydrozo Enviroseal; Double 7 for Brick.
d. Huls; Chem-Trete BSM20 or Aqua-Trete.

2. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
3. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:

1. Cast-in-Place Concrete and Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857.

C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply coating of water repellent on surfaces to be treated using 15 psi-pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 19 00

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Polyisocyanurate board insulation
2. Glass-fiber blanket insulation.
3. Sound attenuation batts.

B. Related Sections:

1. Section 06 16 00 - "Sheathing" for foam-plastic board sheathing over cold-formed framing.
2. Section 07 54 19 – “Polyvinyl-Chloride (PVC) Roofing" for insulation specified as part of roofing construction.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than 25 and 450 when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

D. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

E. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

F. Thermal-Resistance Value (R-Value): R-value as indicated below in accordance with ASTM C518.

2.2 POLYISOCYANURATE BOARD INSULATION

A. Foil-Faced, Polyisocyanurate Board Insulation for interior application on masonry and concrete substrates: ASTM C1289, Type I, Class 2, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The); THERMAX Insulation.
b. Rmax, Inc: TSX-8500.
c. Johns Manville: a Berkshire Hathaway Company
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Insulation shall meet requirements to allow for exposed use without the need for a thermal barrier. Product must meet NFPA286, FM 4880 or UL1715.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

1. Thickness: 2 inches.
2. R-Value: R-13 minimum.

2.3 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corporation
2. Johns Manville: a Berkshire Hathaway Company

3. Owens Corning

B. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Unfaced, Glass-Fiber Blanket Insulation: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

D. Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

E. Thickness: 2-1/2, 3-5/8, 6, or 8 inches as indicated on Drawings.

F. R-Value (min.):
1. 2-1/2” studs: R-7.3.
2. 3-5/8” studs: R-11
3. 6” studs: R-19
4. 8” studs: R-25

G. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D5116 and shown to emit less than 0.05-ppm formaldehyde.

2.4 ACOUSTIC BLANKET SOUND INSULATION (SOUND ATTENUATION BATTS)

A. Unfaced glass fiber acoustical insulation: ASTM C665, Type I, with maximum flame-spread and smoke-developed indexes of 10 and 10, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Owens-Corning PINK NextGen Sound Attenuation Batts

2. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

3. Min STC rating:
a. 2-1/2” studs: 39.
b. 3-5/8” studs: 49.

2.5 GLASS-FIBER ACOUSTICAL BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Knauf Insulation; ECOSE Black Acoustical Board
2. Owens Corning; SelectSound Black Acoustic Board

B. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Black Faced Glass-Fiber Acoustical Board Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

D. Thickness: 1 inch.

E. NRC: 0.75

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foil Faced, Polyisocyanurate Board Insulation:
   1. Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.
   2. Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

3.4 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.5 INSTALLATION OF ALUMINUM-FRAMED STOREFRONTS INSULATION

A. Install board insulation in aluminum framed-storefront spandrel construction where indicated on Drawings according to aluminum framed-storefront manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 42 14 - FORMED METAL WALL & SOFFIT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preformed, exposed fastener, flat seam metal wall panel system including anchor clips, fasteners, flashing, trim, and weather barrier.

2. Preformed, concealed fastener, lap seam metal soffit panel system including anchor clips, fasteners, flashing, trim, and weather barrier.

B. Related Sections:

1. Section 06 16 00 - "Sheathing" for wall sheathing behind metal wall panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal soffit panel installer, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers, and electrical fixtures.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review temporary protection requirements for metal panel assembly during and after installation.
7. Review of procedures for repair of metal panels damaged after installation.
8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels and soffits; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each panel configuration, samples of size indicated below:

1. Metal Panels and Metal Soffit Panels: Minimum 24 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels and soffits, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels and soffits horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels and soffits to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

A. Coordinate metal panel and soffit installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel and soffit systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with Reverse Bos Rib profile spaced at 7-13/64 inches o.c. across width of panel.

1. Manufacturers: Subject to compliance with requirements,
2. Basis-of-Design Product: Subject to compliance with requirements, provide ‘Reverse Box Rib’ by AEP Span or comparable product by one of the following:

   a. Petersen Aluminum, Pac- Clad.
   b. Metal Sales Manufacturing Corporation.
3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.
4. Metallic-Coated Steel Sheet:

   a. Panels installed over sheathing and weather barrier:

      1) Zinc-coated (galvanized) steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality.
      2) Nominal Thickness: 0.034 inch (22 gauge).

   b. Exterior Finish: Three-coat fluoropolymer.
   c. Color: To be Selected by Architect from manufacturer’s full range.

5. Panel Coverage: 36 inches.
6. Panel Height: 1.5 inch.

2.3 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide 'Prestige Series' by AEP Span or comparable product by one of the following:

    a. Petersen Aluminum, Pac- Clad.
    b. Metal Sales Manufacturing Corporation.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Nominal Thickness: 0.028 inch.
    b. Exterior Finish: Three-coat fluoropolymer
    c. Color: To be Selected by Architect from manufacturer's full range.

3. Panel Coverage: 12 inches.
4. Panel Height: 1.5 inches.
5. Provide round, matching escutcheons at steel tube columns, fabricated from the same material as the soffit panels.

2.4 MISCELLANEOUS MATERIALS

A. Underlayment: Include weather barrier over wall sheathing. See additional information elsewhere in this Section.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes,

fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Stainless steel self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide neoprene bonded sealing washers with finish to match panel color for exposed fasteners.

E. Lap Fasteners: Panel fasteners which are used to stitch panels together at panel laps shall be stainless steel self-tapping screws with neoprene bonded washers painted to match panel color in size as recommended by manufacturer.

F. Exposed Trim Fasteners: Stainless-steel fasteners painted to match panel color as recommended by manufacturer.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Exposed Applications: Tripolymer of polyurethane sealant or equal in color as selected by Architect from manufacturer’s standard range.

H. WEATHER BARRIER

1. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
   b. Ludlow Coated Products, Barricade Building Wrap.
   c. Pactiv, Inc.; GreenGuard Ultra Wrap.
   d. Raven Industries Inc.; Fortress Pro Weather Protective Barrier.

3. Water-Vapor Permeance: Not less than 20 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).

4. Allowable UV Exposure Time: Not less than three months.

5. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.5 FABRICATION

A. General: Fabricate and finish metal panels, soffits and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

3. All products shall be “0 (Zero) Lead”, utilizing the lead safe work practices identified in the EPA Guidance Document titled “Steps to Lead Safe Renovation,

Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 775-851-5675.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Locate and space fastenings in uniform vertical and horizontal alignment.
4. Install flashing and trim as metal panel work proceeds.
5. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
6. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 INSTALLATION OF METAL SOFFIT PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and

similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 14

SECTION 07 54 19 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adhered polyvinyl-chloride (PVC) roofing system.
2. Coverboard
3. Vapor Retarder
4. Roof insulation.
5. Walkways and splashpads.

B. Section includes the installation of insulation strips in ribs of roof deck. Insulation strips are furnished under Section 05 31 00 - "Steel Decking."

C. Related Requirements:

1. Section 07 71 00 - "Roof Specialties" for metal roof flashings and counterflashings.
2. Section 07 62 00 - "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 92 00 - "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Section 07 21 00 - “Thermal Insulation”.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 INSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
1. Meet with Owner, Architect, Construction Manager, Owner's roofing consultant, , roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's roofing consultant, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

C. Finished Roof Inspection: Upon completion of all specified roofing items, a finished roof inspection shall be performed with the following in attendance: roofing contractor, roofing manufacturer’s technical representative, architect, owner’s representative, and any applicable subcontractors. Any discrepancies or incomplete work shall be documented in a list of corrective actions which will be issued to the contractor. A finished roof inspection is required at the completion of the roofing membrane installation. Finalization of all requirements from the finished roof inspection is a prerequisite for the mandatory flood test described below.

D. Flood Test: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing, but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water. Flood test shall be conducted by the Contractor in the presence of the Washoe County School District representative.

1. Provide simulated rain test across field of roof for 60 minutes each area and provide flood test of including membrane target area.
2. Plug all roof drains in each drainage area and fill to a depth of 4” minimum, 6” maximum measured at the drains. Allow to stand for a minimum of 48 hours.
3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
4. Contractor shall provide and/or arrange for all necessary equipment, supplies, water, etc. as needed to perform these tests.
5. Acceptable flood test performance, as determined by the Owner, is a prerequisite for the Final Roof Inspection.
6. Flood test must be completed and verified prior to filing for Substantial Completion.

7. Notify Architect and Owner 48 hours in advance of date and time of inspection and flood testing.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
2. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Walkway pads or rolls, of color required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

C. Product Test Reports: For components of roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

E. Sample Warranties: For manufacturer's special warranties.

F. Letter of certification from the primary Manufacturer stating that the system specified or proposed is appropriate for the geographical area and type deck, that the specified requirements are either acceptable or exceed their requirements for the specified guarantees, and that the systems comply with specified UL requirements. Any items not acceptable or detrimental to system performance shall be noted prior to bid for review and clarification.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Global approved for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, coping and counterflashing, and other components of roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation for roofing system from manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D3746 or ASTM D4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures.

1. Corner Uplift Pressure: 131 psf (ASCE 7-16 Figure 30.4-1, Zone 3)
2. Perimeter Uplift Pressure: 90 psf (ASCE 7-16 Figure 30.4-1, Zone2)
3. Field-of-Roof Uplift Pressure: 68 psf (ASCE 7-16 Figure 30.4-1, Zone 1)
4. Based upon an Ultimate Design Wind Speed of 130 mph.

D. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a single-ply roofing system and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail-Resistance Rating: MH.

E. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 PVC ROOFING

A. PVC Sheet: ASTM D 4434/D 4434M, Type III, fabric reinforced, and fabric backed.

1. Thickness: 60 mils, nominal.
2. Exposed Face Color: White.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil G-410 Feltback or comparable product in accordance with Division 1 Section “Product Requirements”.

1. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Single-Ply Roof Membrane Adhesives: 250 g/L.
f. PVC Welding Compounds: 510 g/L.
g. Adhesive Primer for Plastic: 650 g/L
h. Single-Ply Roof Membrane Sealants: 450 g/L.
i. Nonmembrane Roof Sealants: 300 g/L.
j. Sealant Primers for Nonporous Substrates: 250 g/L.
k. Sealant Primers for Porous Substrates: 775 g/L.
l. Other Adhesives and Sealants: 250 g/L.

B. Sheet Flashing: Manufacturer's standard flashing sheet (of same material, type, reinforcement, thickness, and color as PVC sheet).

C. Scupper Drain: Custom fabricated scupper drains to profiles and shapes indicated. Fabricate from sheet flashing material specified above.

D. Bonding Adhesive: Manufacturer's standard, water based. Suitable for both horizontal and vertical surfaces. Follow manufacturer’s instructions for direction and height limitations.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Reglet and Flashing: 24-gauge galvanized steel reglet and spring-action flashing.

1. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:

a. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.

G. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 VAPOR RETARDER

A. Self-Adhering-Sheet Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 10-mil-total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer. Product shall be acceptable to the roofing system manufacturer.

1. Basis-of-Design Product: Subject to compliance requirements, provide Vapor Retarder SA 31, by SIKA Sarnafil or equal.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by PVC roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses required to achieve a minimum R30 R-value.

B. Polyisocyanurate Board Insulation: ASTM C 1289 Type II, Class 1, Grade 2, coated glass facers on both major surfaces. of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 25 and less than 450, respectively, per ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil, Sarnatherm – 20 psi, Roof Insulation or a comparable product that may be incorporated into the Work including, but not limited to, the following:

a. ENERGY 3 by Johns Mansville Roofing Systems Group
b. Insulbase by Carlisle SynTecSystems
c. Elevate Building Products.

2. Long-Term Thermal Resistance: R-23.6 at 4”.
3. Compressive Resistance ASTM C1621: 20 psi min.
4. Tensile Strength ASTM D1623: 730 psi.
5. Water Absorption ASTM C209, % by volume, max: <1.0.
6. Moisture Vapor Permeance ASTM E96: <1 perms.
7. Dimensional Stability Change (length & width) ASTM D2126: <2% linear.

C. Tapered Expanded Polystyrene Board Insulation: ASTM C578 of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 25 and less than 450, respectively, per ASTM E84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil, Sarnatherm EPS Tapered or comparable product that may be incorporated into the Work including, but not limited to, the following:

a. Insulfoam, tapered insulation by Carlisle SynTec Systems.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

1. Length: Fastener length shall not exceed depth of structural steel deck.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Full-spread or bead-applied, low-rise, two-component urethane adhesive.

D. Cover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick, factory primed.

2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Georgia-Pacific Building Products; Dens Deck Prime.
b. United States Gypsum Company; Securock Glass Mat Roof Board.

2.8 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil, Sarnatred - V or comparable product acceptable to the roofing membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of each workday. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roofing and auxiliary materials to tie into existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.4 VAPOR-RETARDER INSTALLATION

A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 4 inches and 6 inches, respectively with butyl tape. Seal laps by rolling.

B. Extend vapor retarder up perimeter walls and curbs to the future height up the roofing insulation.

C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSULATION INSTALLATION

A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches in each direction.

D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

F. Mechanically Fastened and Adhered Insulation: Install each layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Loose-lay first and mechanically attach the second layer of insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
2. Set each subsequent layer of insulation in a uniform coverage of bead-applied or full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

G. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 12 inches in each direction. Loosely butt cover boards together.

1. Adhere cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.

3.6 ADHERED ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

1. Install sheet according to ASTM D 5036.

B. Accurately align roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Bonding Adhesive: Apply to substrate and/or (as recommended by adhesive manufacturer) underside of roofing at rate required by manufacturer. Broom in place, then, using 75lb. minimum steel roller, immediately roll the membrane into the adhesive while the adhesive is wet. Do not apply to splice area of roofing. See manufacturer’s installation guides.

D. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing as required by manufacturer.

E. Apply roofing with side laps shingled with slope of roof deck where possible.

F. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant as required to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

G. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars. Provide sealant behind the top edge of the flashing.

3.8 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated.

1. Adhere center with adhesive, and hot-air weld all edges watertight.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

D. Patches shall be limited to a maximum of three patches on any 100 square foot area. Excessive patching or damage to the finished roof membrane will be grounds for the WCSD to require replacement of the entire roofing membrane at the Contractor’s expense.

E. The installed PVC membrane shall be visually free of pinholes, particles of foreign matter, undispersed raw material, protruding fibers or reinforcement. Sheets shall be free of nicks, cuts, scratches, abrasions, voids, and any other defects upon completion of the Work.

F. The Owner and the membrane roofing manufacturer reserve the right to perform 6 test cuts at no additional cost.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 19

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed wall sheet metal fabrications.
2. Roof-drainage sheet metal fabrications.

B. Related Requirements:

1. Section 09 91 13 - "Exterior Painting" for exterior painting at wall sheet metal fabrications.
2. Section 07 92 00 - "Joint Sealants" for exterior sealants at wall sheet metal fabrications.
3. Section 07 42 14 – “Formed Metal Wall & Soffit Panels" for sheet metal flashing and trim integral with metal wall panels.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.5 ACTION SUBMITTALS

A. Product Data:
1. Roof-drainage sheet metal fabrications.

B. Shop Drawings: For sheet metal flashing and trim.
1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.

3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Smooth, flat.
2. Finish: Three-coat fluoropolymer.

1) All finish products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 775-851-5675.

3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Cleats and attachment devices shall be 1 guage heavier than the accessory being anchored.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:
   1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. [Rivet joints where necessary for strength.]

H. Do not use graphite pencils to mark metal surfaces.

2.5 WALL SHEET METAL FABRICATIONS

A. Opening Trim in Masonry Construction: Fabricate head, sills, jamb**,** and similar flashings to extend 4 inches beyond wall openings.

   1. Galvanized Steel: 0.022 inch thick.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.
   1. Fabricate from the following materials:
      a. Galvanized Steel: 0.022 inch thick.

B. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
   1. Galvanized Steel: [0.028 inch] <Insert dimension> thick.

C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and [built-in overflows]. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
4. Torch cutting of sheet metal flashing and trim is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant.

When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Downspouts:
1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 48 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.
5. Connect downspouts to underground drainage system.

C. Parapet Scuppers:
1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
3. Loosely lock front edge of scupper with conductor head.
4. Solder ort seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copings.
2. Reglets and counter flashings.

B. Related Requirements:

1. Section 07 71 00 - "Roof Specialties" for custom- and site-fabricated sheet metal flashing and trim.
2. Section 07 72 00 - "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Section 07 92 00 - "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.
4. Section 07 54 19 - “PVC Roofing”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

D. Samples for Verification:

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
2. Include copings made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and ANSI SPRI ES-1 tested to specified design pressure.

B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 07 54 19 "Polyvinyl-Chloride (PVC) Roofing”.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Roofing-System Warranty: Roof specialties are to be included in Special Warranty provisions in Section 07 54 19 "Polyvinyl-Chloride (PVC) Roofing".

B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F , material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Metallic-Coated Steel Sheet Coping Caps: Zinc-coated (galvanized) steel, 22 gauge.

a. Surface: Smooth, flat finish.
b. Finish: Three-coat fluoropolymer.

1) **All finish products shall be “0 (Zero) Lead”, utilizing the lead safe work practices identified in the EPA Guidance Document titled “Steps to Lead Safe Renovation, Repair and Painting”, pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675**.

c. Color: As selected by Architect from manufacturer's full range.
d. Width: 8 inches and 12 inches nominal as indicated Drawings.

2. Corners: Factory mitered and continuously welded.
3. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.

a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.

2.3 REGLETS AND COUNTERFLASHINGS

A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
2. Corners: Factory mitered and continuously welded.
3. Masonry Type embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.

B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:

1. Zinc-Coated Steel: Nominal 0.028-inch thickness.

C. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.

D. Zinc-Coated Steel Finish: Three-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.
2. **All finish products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

2.4 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

B. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. All finish products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with coating or by other permanent separation as recommended by manufacturer.

1. Bed flanges in thick coat of roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.3 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.4 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof hatches.

B. Related Sections:

1. Section 05 51 33 - "Aluminum Ladders" for cross-over ladders, and ships ladders for access to roof hatches.
2. Section 07 71 00 - "Roof Specialties" for manufactured fascia, copings, gravel stops, gutters and downspouts, and counterflashing.
3. Section 08 62 23 - "Tubular Daylighting Devices" for double-glazed domed plastic skylights with curb frame.
4. Section 07 54 19 - “PVC Roofing” for roofing membrane.
5. Section 07 92 00 - “Joint Sealants”.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide The Bilco Company; Type NB Roof Hatch or comparable product by one of the following:

a. JL Industries, Inc
b. Nystrom, Inc.

3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Type and Size: Single-leaf lid, 42 by 56 inches.

C. Loads: Minimum external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Aluminum-zinc alloy-coated steel sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.
2. Finish: Two-coat fluoropolymer.

a. All finish products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.

3. Color: As selected by Architect from manufacturer's full range.

E. Construction:

1. Insulation: Polyisocyanurate board.

a. R-Value: 6.0 minimum according to ASTM C1363.

2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
6. Fabricate curbs to minimum height of 12 inches above finished roofing surface unless otherwise indicated.
7. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

1. Provide two-point latch on lids larger than 84 inches.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
9. Fabricate joints exposed to weather to be watertight.
10. Fasteners: Manufacturer's standard, finished to match railing system.

11. Finish: Manufacturer's standard.

    a. Color: As selected by Architect from manufacturer's full range.
    b. All finish products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.

2.3 METAL MATERIALS

A. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 coated.

1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
    b. All finish products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.

2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

C. Stainless-Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.

D. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

E. Steel Tube: ASTM A 500/A 500M, round tube.

F. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

G. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
   1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
   2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

   1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with coating approved by roofing manufacturer where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Install safety railing system as recommended by manufacturer.

D. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Clean off excess sealants.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Penetration firestopping systems.

B. Related Requirements:

1. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction.

1.2 ACTION SUBMITTALS

A. Product Data: Penetration firestopping systems.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Submit manufacturer’s data for each product used onsite.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain penetration firestop systems for each type of opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test in accordance with testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    a. Penetration firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
        1) UL in its online directory "Product iQ."
        2) Intertek Group in its "Directory of Building Products."
        3) FM Approvals in its "Approval Guide."

2.3 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems are to be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.

1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.

2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of the floor penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of the floor. The following floor penetrations do not require a T-rating:
   a. Those within the cavity of a wall.
   b. Floor, tub, or shower drains within a concealed space.
   c. 4-inch or smaller metal conduit penetrating directly into metal-enclosed electrical switchgear.
3. W-Rating: Provide penetration firestopping systems with a Class 1 W-rating in accordance with UL 1479.

D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, in accordance with ASTM E84.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.4 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for use around combustible penetrants.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

K. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls to accept standard accessories.

L. Thermal Wrap: Flexible protective wrap tested and listed for up to 2-hour fire ratings in accordance with ASTM E814 or UL 1479 for membrane penetrations or ASTM E1725 or UL 1724 for thermal barrier and circuit integrity protection.

M. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and requiring no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.

N. Retrofit Device for Cable Bundles: Factory-made, intumescent, collar-like device for firestopping existing over-filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.

O. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.

P. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use around rectangular steel HVAC ducts without fire dampers.

Q. Firestop Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.

R. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch in diameter.

S. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.

T. Endothermic Wrap: Flexible, insulating, fire-resistant, endothermic wrap for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines.

2.5 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated construction.
2. Joints at exterior wall/floor intersections.
3. Joints in smoke barriers.

B. Related Requirements:

1. Section 07 84 13 - "Penetration Firestopping" for penetrations in fire-resistance-rated walls, and horizontal assemblies.
2. Section 07 95 13.13 - "Interior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
3. Section 07 95 13.16 - "Exterior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.
4. Section 09 22 16 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Joints in or between fire-resistance-rated construction.
2. Joints at exterior wall/floor/roof intersections.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with Listed System Designs published by a qualified testing agency.
        1) UL in its online directory "Product iQ."

2) Intertek Group in its "Directory of Building Products."

B. Rain/Water Resistance: For perimeter fire-barrier system applications, where inclement weather or greater-than-transient water exposure is expected, use products that dry rapidly and cure in the presence of atmospheric moisture sufficient to pass ASTM D6904 early rain-resistance test (24-hour exposure).

2.3 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
3. Provide firestop products that do not contain ethylene glycol.

B. Intumescent Gypsum Wall Framing Gaskets (Applied to Steel Tracks, Runners, and Studs prior to Framing Installation): Provide products with fire, smoke, and acoustical ratings that allow movement up to 100 percent compression and/or extension in accordance with UL 2079 or ASTM E1966; have an L Rating less than 1 cfm/ft. in accordance with UL 2079; and a minimum Sound Transmission Class (STC) rating of 56 in accordance with ASTM E90 or ASTM C919.

C. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Fireline F140 Fire Barrier Systems – Fire Blanket, by inpro Corporation, S80 W18766 Apollo Dr., Muskego, WI 52150, 800-222-5556, www.inpro.com or comparable product in accordance with Division 1 Section “Product Requirements”.
   a. Assembly Rating: 2 hours.
   b. Nominal Joint Width: 4 inches.
   c. Movement Capabilities: Class III compression or extension.
3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.4 ACCESSORIES

A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition occurs, such as the intersection of a gypsum wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.

3.3 INSTALLATION

A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft..

B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

B. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Requirements:

See the following Specification Sections:

1. 03 34 50 - “Concrete Finishing”
2. 04 22 00 - “Concrete Unit Masonry”
3. 07 72 00 - “Roof Accessories”.
4. 07 71 00 - “Roof Specialties”.
5. 08 11 13 - “Hollow Metal Doors and Frames”.
6. 08 91 19 - “Fixed Louvers”.
7. 08 41 13 - “Aluminum-Framed Entrances and Storefronts”.
8. 08 51 13 - “Aluminum Windows”.
9. 21 13 00 - “Fire Suppression Sprinkler Systems” for floor penetrations.
10. 22 00 00 - “Plumbing” and 22 05 00 - “Basic Materials and Methods for Plumbing” for floor penetrations.
11. 23 00 00 - “Heating, Ventilating, And Air Conditioning” and 23 05 00 - “Basic Materials and Methods For HVAC” for floor penetrations.
12. 26 00 01 - “Electrical General Provisions” for floor penetrations.
13. 27 05 00 - “Common Work Results for Communications” for floor penetrations.
14. 28 00 00 - “Common Work Results for Electronic Safety and Security” for floor penetrations.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Butyl joint sealants.
6. Latex joint sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by the manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the owner.

1.8 DELIVERY AND STORAGE

A. Deliver all materials of this Section to the job site in the original unopened containers with all labels intact and legible at the time of use. Store only under conditions recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Definitions: The terms “sealant” and “caulk” as used herein and as shown on the Drawings shall be interchangeable and shall mean all sealing and caulking materials including elastomeric sealants, non-elastomeric sealants, acrylic sealants, mastic, adhesives, foam, firestop, primers, and back up materials required.

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

C. Size and Shape: As shown or, if not shown, as recommended by the manufacturer for the type and condition of joint, and for the indicated joint performance or movement.

D. Grade of Sealant: For each application, provide the grade of sealant (non-sag or self-leveling) as recommended by the manufacturer for the particular condition of installation (location, joint shape, ambient temperature, and similar conditions), to achieve the best possible overall performance. Grades specified herein are for normal conditions of installation.

E. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

G. Contractor shall provide the proper sealant, primer, backer rod, bond breakers and other accessories required for each different substrate and application as recommended by the manufacture for the installation.

2.2 SILICONE JOINT SEALANTS

A. Silicone, T, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; Dow Corning® 791 Silicone Weatherproofing Sealant.
b. GE Construction Sealants; Momentive Performance Materials Inc; SCS2000 SilPruf.
c. Pecora Corporation; 896-TBS
d. Sika Corporation; Joint Sealants; Sikasil WS-295
e. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; Pecora 890FTS
b. Sika Corporation; Joint Sealants; Sikasil WS-290 FPS
c. Tremco Incorporated; Spectrem
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, paintable, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; Dynatrol I-XL.
b. Sika Corporation; Joint Sealants; Sikaflex Textured Sealant.
c. Tremco Incorporated; Dymonic.
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; DOW CORNING® 786 SILICONE SEALANT -.
b. Pecora Corporation; Pecora 860.
c. Tremco Incorporated; Tremsil 200.
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Bostik, Inc; Chem-Calk 300.
b. Pecora Corporation; BC-158.

c. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; AC-20**.**
b. Sherwin-Williams Company (The); 850A Siliconized Acrylic Latex Caulk.
c. Tremco Incorporated; Tremflex 834.
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.9 BOND-PREVENTATIVE MATERIALS

A. General: Use only those backup materials which are specifically recommended for this installation by the manufacturer of the sealant used, and which as nonabsorbent and nonstaining.

B. Backer-Rod: Closed-cell polyethylene foam backer-rod as a stopper or other material as recommended by the manufacturer.

C. Polyethylene Tape: Pressure-sensitive adhesive, with the adhesive required only to hold tape to the construction materials as indicated.

2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cylindrical Sealant Backing: ASTM C 1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for specific application.

C. Bond Breaker Tape: Polymer tape compatible with joint sealant materials and recommended by sealant manufactuer.

D. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

E. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean, porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Glass.
    b. Porcelain enamel.
    c. Phenolic Wall Panels.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in horizontal traffic surfaces

1. Joint Locations:

a. Isolation, control and contraction joints in cast-in-place concrete slabs.

1) Including, but not limited to sealed concrete slabs and epoxy painted concrete slabs.

b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, nonstaining, T
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.
c. Joints in exterior insulation and finish systems.
d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
e. Control and expansion joints in and other.
f. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: All penetrations through slab-on-grade and concrete-filled metal decks to be sealed watertight.

1. Joint Locations:

a. Joints between plumbing piping, ductwork, and electrical conduit.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints on vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
c. Perimeter joints between interior wall surfaces and frames of fire extinguisher cabinets and tackable wall surfaces.
d. All contractor-installed semi-recessed or flush-mounted items.

e. All solid surface sills, counters & backsplash: all joints and edges
f. Plywood edges (IDF, MDF & Electrical Rooms): caulk all edges before painting.
g. All joints between dissimilar materials.
h. Ceiling grids, if unable to install grid tight to wall.
i. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Interior standard steel frames.

B. Related Requirements:
1. Section 07 92 00 - “Joint Sealants”.
2. Section 08 71 00 - "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.

8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Door Components, Inc.
4. Steelcraft; an Allegion brand; Steelcraft Hollow Metal Doors and Frames

B. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches.
   c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
   d. Edge Construction: Model 2, Seamless.
   e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
   f. Core: Vertical steel stiffener.
3. Frames:
   a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
   b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot dip galvanized according to ASTM A153/A153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M.

H. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.

4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

4. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

6. Terminated Stops: Terminate stops 6 inches above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

C. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
2. Provide loose stops and moldings on inside of hollow-metal work.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. At fire-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus, or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus, or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus, or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus, or minus 1/16 inch, measured at jambs at floor.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 08 80 00 - "Glazing" for glass view panels in flush wood doors.
2. Section 08 71 00 - “Door Hardware” for door hardware in/on flush wood doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

    a. Provide Samples for each species of veneer and solid lumber required.

b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 17 and 50 percent during remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Exterior Doors: Five years from date of Substantial Completion.
4. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eggers Industries
2. Graham Wood Doors; ASSA ABLOY Group company.
3. Marshfield Door Systems, Inc; Wood Veneered Doors.
4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Source Limitations: Obtain flush wood doors and wood paneling from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
3. Pairs: Provide formed-steel edges and astragals with intumescent seals.

a. Finish steel edges and astragals to match door hardware (locksets or exit devices).

C. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2 or, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

a. 5-inch top-rail blocking, in doors indicated to have closers.
b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
c. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

D. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:

a. 5-inch top-rail blocking.
b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch midrail blocking, in doors indicated to have armor plates.
d. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom (Grade A faces).
2. Species: Select white maple.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
8. Core: Particleboard.
9. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
10. Construction: Seven plies, either bonded or nonbonded construction.

2.4 PLASTIC LAMINATE FACED WOOD DOORS

A. Interior Solid-Core Doors:

1. Grade: Custom (Grade A edges).
2. Faces: Writable High Pressure Plastic Laminate from one of the following:

a. FORMICA White Gloss Finish+Markerboard 949-90

b. WILSONART Markerboard Frosty White 1573-09.

3. Exposed Vertical and Top Edges: Any closed-grain hardwood.
4. Core: Particleboard.
5. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
6. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.5 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.

B. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Air Louvers Inc.
   b. Anemostat; a Mestek company.
   c. L & L Louvers, Inc.
   d. McGill Architectural Products.
   e. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Blade Type: Vision-proof, inverted V or Y.
3. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.

2.6 MANUAL INTEGRAL HORIZONTAL BLIND LITES:

1. Provide manufactures mircoblinds and accessories at doors indicated on Door Schedule (Doors 116B and C135).
   a. Basis-of-Design Product: Subject to compliance with requirements, provide Pariluse LLC; IE Blinds or comparable product by one of the following:

      1) ODL
      2) Thermat-Tru Corp.
      3) Unicel Architectural
      4) Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Glazed integral blind units to be sealed at perimeter.
3. Integral blind units to be assembled and integrated with tempered, laminated, and Low-E glazing as specified in Section 08800 “Glazing.”
4. Controls: Single side direct drive.
5. Color: to be selected by Architect from manufactures full range.

2.7 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

   1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

2.8 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099123" Interior Painting."

2.9 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Use only paints and coatings that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Transparent Finish:

1. Grade: Custom.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 10, UV curable, water based.
3. Staining: None required.
4. Effect: Open-grain finish.
5. Sheen: Satin.
6. **All finish products shall be “0 (Zero) Lead”, utilizing the lead safe work practices identified in the EPA Guidance Document titled “Steps to Lead Safe Renovation, Repair and Painting”, pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore seal finish before installation on surfaces if fitting, cutting or machining is required either at shop or at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 17 43 - FLUSH FRP DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fiberglass reinforced polyester (FRP) flush doors with aluminum frames.

B. Related Requirements:

1. Section 08 71 00 - "Door Hardware" for door hardware for Fiberglass reinforced polyester (FRP) flush doors.
2. Section 08 80 00 - "Glazing" for glass view panels in Fiberglass reinforced polyester (FRP) flush doors.

1.3 PERFORMANCE REQUIRMENTS

A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

B. Air Infiltration: For a single door 3’-0” x 7’-0”, test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.27 psf. Door shall not exceed 0.58 cfm/ft^2.

C. Water Resistance: For a single door 3’-0” x 7’-0”, test specimen shall be tested in accordance with ASTM E 331 at pressure differential of 7.50 psf. Door shall not have water leakage.

D. Indoor air quality testing per ASTM D6670-01: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification.

E. Hurricane Test Standards, Single Door:

1. Uniform Static Load, ASTM E 330: Plus or minus 195 pounds per square foot.
2. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b)(5): Passed.
3. Cyclic Load Test, SFBC PA 203: Plus or minus 53 pounds per square foot.
4. Large Missile Impact Test, SFBC PA 201: Passed.

F. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 25,000,000 cycles.

G. Cycle Slam Test Method, NWWDA T.M. 7-90: Minimum 5,000,000 Cycles.

H. Sound Transmission, Exterior Doors, STC, ASTM E 90: Minimum of 26.

I. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503-98: Maximum of 0.29 BTU/hr x sf x degrees F. Minimum of 55 CRF value.

J. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:

1. Flame Spread: Maximum of 25.
2. Smoke Developed: Maximum of 450.

K. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D256: 14.0 foot-pounds per inch of notch.

L. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D638: 12,000 psi.

M. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D790: 21,000 psi.

N. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D570: 0.20 percent after 24 hours.

O. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D2583: 55.

P. Gardner Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D5420: 120 in-lb.

Q. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

R. Stain Resistance, ASTM D1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.

S. Chemical Resistance, ASTM D543. Excellent rating.

1. Acetic acid, Concentrated.
2. Ammonium Hydroxide, Concentrated.
3. Citric Acid, 10%.
4. Formaldehyde.
5. Hydrochloric Acid, 10%
6. Sodium hypochlorite, 4 to 6 percent solution.

T. Compressive Strength, Foam Core, Nominal Value, ASTM D1621: 79.9 psi.

U. Compressive Modulus, Foam Core, Nominal Value, ASTM D1621: 370 psi.

V. Tensile Adhesion, Foam Core, Nominal Value, ASTM D1623: 45.3 psi.

W. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D2126: Minus 5.14 percent volume change.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.

B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.

C. Samples for Initial Selection: For Flush FRP doors.

D. Samples for Verification:

1. Door: Submit manufacturer's sample of door showing face sheets, core, framing, and finish.
2. Color: Submit manufacturer's samples of standard colors of doors and frames.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: Submit manufacturer's standard warranty.

B. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
2. 2. Door and frame components from same manufacturer.
3. 3. Evidence of a compliant documented quality management system.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

D. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 WARRANTY

A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Warranty Period: Ten years starting on date of shipment. In addition, a limited lifetime (while the door is in its specified application in its original installation) warranty covering: failure of corner joinery, core deterioration, delamination or bubbling of door skin.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Special Lite Inc.
2. Curries, Assa Abloy.
3. Cline Doors.

B. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 FLUSH FRP DOORS, GENERAL - FRP

A. Construction:

1. Door Thickness: 1-3/4 inches.
2. Stiles and Rails: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes, minimum of 2-5/16-inch depth.
3. Corners: Mitered.
4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom integral to standard tubular shaped stiles and rails reinforced to accept hardware as specified.
5. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
6. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
7. Rail caps or other face sheet capture methods are not acceptable.
8. Extrude top and bottom rail legs for interlocking continuous weather bar.
9. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
10. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
    a. Install Adjustable Door Bottom SL-301 where indicated in Door Hardware Schedule.
11. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.

B. Face Sheet:

1. Fiberglass Reinforced Polyester (FRP), 0.120-inch thickness, finish color throughout.
2. Protective coating: Abuse-resistant engineered surface. Provide FRP with SpecLite3 protective coating, or equal.
3. Texture: Sandstone as selected by Architect.
4. Color: Selected from manufacturers standard colors.

5. Adhesion: The use of glue to bond face sheet to foam core is prohibited.

C. Core:

1. Material: Poured-in-place polyurethane foam.
2. Density: Minimum of 5 pounds per cubic foot.
3. R-Value: Minimum of 9.
4. ASTM E84: Class A.

D. Cutouts:

1. Manufacture doors with cutouts for required vision lites, louvers, and panels.
2. Factory install vision lites, louvers, and panels.

E. Hardware:

1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

2.3 MATERIALS

A. Aluminum Members:

1. Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes: ASTM B 221.
2. Sheet and Plate: ASTM B 209.
3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

B. Components: Door and frame components from same manufacturer.

C. Fasteners:

1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
2. Compatibility: Compatible with items to be fastened.
3. Exposed Fasteners: Screws with finish matching items to be fastened.

2.4 FABRICATION

A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

C. Assembly:

1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
2. Remove burrs from cut edges.
3. Provide solid blocking and/or reinforcement for all scheduled door hardware as specified in Section 087100 “Door Hardware.”

D. Welding: Welding of doors or frames is not acceptable.

E. Fit: Maintain continuity of line and accurate relation of planes and angles.
   1. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.5 HARDWARE

A. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

B. Hardware Schedule: As specified in Section 087100 “Door Hardware.”

2.6 VISION LITES.

A. Glazing: As specified in Section 08 80 00 - “Glazing” or Section 088853 “Security Glazing” as indicated on Door Schedule.

B. Lites in Exterior Doors: Allow for thermal expansion.

C. Rectangular Lites:

   1. Size: As shown on Drawings.

2.7 MANUAL INTEGRAL HORIZONTAL BLIND LITES: (Doors B104A, B104B, B104C, B104D, B124, B125, B126A, B126B)

   1. Provide manufactures microblinds and accessories at doors indicated on Door Schedule.

      a. Basis-of-Design Product: Subject to compliance with requirements, provide Pariluse LLC; IE Blinds or comparable product by one of the following:

         1) ODL
         2) Thermat-Tru Corp.
         3) Unicel Architectural

      b. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

   2. Glazed integral blind units to be sealed at perimeter.
   3. Integral blind units to be assembled and integrated with tempered and laminated glazing as specified in Section 08800 “Glazing.”
   4. Controls: Single side direct drive.
   5. Color: to be selected by Architect from manufactures full range.

2.8 ALUMINUM FINISHES

A. Anodized Finish: Class I finish, 0.7 mils thick.

   1. Clear 215 R1, AA-M10C12C22A41, Class I, 0.7 mils thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPERATION

A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION

A. Install doors in accordance with manufacturer's instructions.

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.

D. Set thresholds in bed of mastic and backseal.

E. Install exterior doors to be weathertight in closed position.

F. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

G. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.5 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.6 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OFSECTION 08 17 43

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel Access doors and frames for walls and ceilings.

2. Stainless Steel Access doors and frames for walls and ceilings.

B. Related Requirements:

1. Section 07 72 00 - "Roof Accessories" for roof hatches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

B. Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling.
3. Door Size: 16 inches x 16 inches or as indicated on Drawings.
4. Steel Sheet for Door: Nominal 0.064-inch, 16 gauge.
   a. Finish: Factory finish.
5. Stainless Steel Sheet for Door: Nominal 0.064-inch, 16 gauge.
   a. Stainless Steel Access Doors only required at Kitchen B116 and at all Toilet Rooms throughout project. See exception below for ceilings in toilet rooms.
   b. Finish: No 04.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Lock.

C. Flush Access Doors with Concealed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size. Flange to be taped & textured to be concealed.
2. Locations:
   a. Gypsum Board Wall and ceiling – Classrooms, Corridors & Public Areas.
   b. Ceilings - Toilets A114T, B107T, B118T, C142T & C242T.
3. Door Size: 16 inches x 16 inches or as indicated on Drawings.
4. Steel Sheet for Door: Nominal 0.064-inch, 16 gauge.
   a. Finish: Factory primed finish. Paint to match ceiling/wall.
5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Lock.

D. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling.
3. Fire-Resistance Rating: Not less than 1 hour.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.040-inch, 20 gauge.

   a. Finish: Factory finish.

5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Lock.

E. Hardware:

1. Lock: Cylinder.

a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 08 71 00 "Door Hardware."

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. Provide mounting holes in frames for attachment of units to metal framing.
2. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.:

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

E. Stainless Steel Finishes:
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
   a. Run grain of directional finishes with long dimension of each piece.
   b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.4 Cleaning

A. Remove all visible factory labels.

B. Clean all fingerprints prior to Substantial Completion.

END OF SECTION 08 31 13

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for punched openings.

B. Related Requirements:

1. Section 07 92 00 - “Joint Sealants”.
2. Sections 08 14 16 - “Flush Wood Doors” and 081743 “Flush FRP Doors” for doors in Aluminum-Framed Storefronts.
3. Section 08 71 00 - "Door Hardware" for door hardware for doors in Aluminum-Framed Storefronts.
4. Section 08 51 13 - "Aluminum Windows" for windows installed in Aluminum-Framed Storefronts.
5. Section 08 80 00 - “Glazing” for glazing installed in Aluminum-Framed Storefronts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Required Preinstallation Conference attendees:
a. General Contractor
b. Storefront subcontractor
c. Rigid Insulation Subcontractor
d. Metal Stud Framing Subcontractor
e. Gypsum Wallboard Subcontractor
f. Aluminum Windows Subcontractor
g. Caulking Subcontractor

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

1.9 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as described in Section 01 43 39 – Classroom Mockup.
2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Noise or vibration created by wind and thermal and structural movements.
    d. Loosening or weakening of fasteners, attachments, and other components.
    e. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite

or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

    a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

D. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

F. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.

G. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.57 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than **35** as determined according to NFRC 500.

H. Noise Reduction: Test according to ASTM E90, with ratings determined by ASTM E1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 34.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.
c. Interior Ambient-Air Temperature: 75 deg F.

2.2 EXTERIOR FRAMING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, an Arconic company; Trifab 601 T Framing System, or comparable product by one of the following:

1. EFCO Corporation.
2. U.S. Aluminum; a brand of C.R. Laurence.
3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: Class I, Clear Anodic Finish.
5. Fabrication Method: Field-fabricated stick system.

D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

F. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B 209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.
e. Location: As Indicated on Drawings.

2.3 INTERIOR FRAMING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, an Arconic company; Trifab VersaGlaze 451 Framing System, or comparable product by one of the following:

1. EFCO Corporation.
2. U.S. Aluminum; a brand of C.R. Laurence.
3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Non-thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: Class I, Clear Anodic Finish.
5. Fabrication Method: Field-fabricated stick system.

D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

F. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B 209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.
e. Location: As Indicated on Drawings.

2.4 GLAZING

A. Glazing: Comply with Section 08 80 00 - "Glazing.

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.5 LOUVERS

A. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Special-Lite
   b. Air Louvers Inc.
   c. Anemostat; a Mestek company.
   d. L & L Louvers, Inc.
   e. McGill Architectural Products.

2. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.
3. Blade Type: Vision-proof, inverted V or Y.
4. Thickness: 1 inch to fit glazing pocket of framing system.
5. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
6. Provide screen at each exterior louver.
7. Insulated, Blank-Off Panels at exterior louvers: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
   a. Thickness: 2 inches.
   b. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
   c. Insulating Core: Rigid polyisocyanurate board insulation.
   d. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
   e. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
   f. Panel Finish: Same type of finish applied to louvers, but black color.
   g. Attach blank-off panels with sheet metal screws.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Storefront Framing: Fabricate components for assembly using shear-block system.

G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 - "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 08 80 00 - "Glazing."

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 08 41 13

SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes aluminum windows for interior and exterior locations with **integral internal manual venetian blinds.**

B. Related Requirements:

1. Section 07 92 00 - “Joint Sealants”.
2. Section 08 41 13 - “Aluminum-Framed Entrances and Storefronts” for frames where Aluminum Windows occur.
3. Section 08 80 00 - “Glazing” for additional glazing requirements for Aluminum Windows.
4. Section 08 88 53 - “Security Glazing” for additional glazing requirements for Aluminum Windows.

1.3 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2017.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

C. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2012.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections; 2009.

G. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

H. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

J. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

L. ASTM E1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation; 2016.

M. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors, and Skylights; 2019c.

N. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2017.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

1.7 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
      c. Faulty operation of movable sash and hardware.
      d. Deterioration of materials and finishes beyond normal weathering.
      e. Failure of insulating glass.

B. Aluminum Window Warranty
   1. 1.Products: Submit a written warranty, executed by the window manufacturer, for a period of 10 years from the date of manufacture, against defective materials or workmanship, including substantial non-compliance with applicable specification requirements and industry standards, which result in premature failure of the windows, finish, factory-glazed glass, or parts, outside of normal wear.
   2. In the event that windows or components are found defective, manufacturer will repair or provide replacement material without charge at manufacturer's option.
   3. Warranty for all components must be direct from the manufacturer (non-pass-through) and non-pro-rated for the entire term. Warranty must be assignable to the non-residential owner, and transferable to subsequent owners through its length.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide 3-1/2" AW (Architectural Window) 4250i INvent Series Thermal Fixed windows w/ internal venetian blind on hinged access sash by Wausau Window and Wall Systems. – DESIGNATED BY 'W' ON GLAZING LEGEND.

B. Basis-of-Design Product: Subject to compliance with requirements, 3-1/2" AW (Architectural Window) 4250i INvent Series Thermal Fixed windows w/ ballistic glazing and internal venetian blind on hinged access sash by Wausau Window and Wall Systems. – DESIGNATED BY 'W3' ON GLAZING LEGEND.

   1. Exterior (non-classroom side) lite to be BR2 Rated per UL752 with Glass surface on outside face.
   2. Interior (classroom side) lite to be 5/16" Laminated Glass with two plies of fully tempered float glass.

      a. Minimum Thickness of Each Glass Ply: 3 mm.
      b. Interlayer Thickness: 0.060 inch.

   3. Interior (classroom side) lite to be 1/4" fully tempered float glass at Window Type A3.

C. Source Limitations: Obtain aluminum windows from single source from single manufacturer,

D. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
   1. Window Certification: AMMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
   1. Minimum Performance Class: AW/HC.
   2. Minimum Performance Grade: 80.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.32 Btu/sq. ft. x h x deg F.

D. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 52.

E. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

2.3 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Casement: Project out.
   2. Fixed.

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
   2. Thermal barrier to be Azo-braided for reduced thermal shrinkage.

C. Glass Type: Insulating-Glass Units: ASTM E 2190.
   1. Glass: ASTM C 1036, Type 1, Class 1, q3.
      a. Tint: Clear exterior lite, clear interior lite.
      b. Kind: 1/4-inch fully tempered exterior lite, 5/16-inch laminated interior lite.
   2. Lites: Two.
   3. Filling: Fill space between glass lites with air.
   4. Low-E Coating: Pyrolytic on second surface.

D. Glass Type: Laminated-Glass Units: ASTM E 2190.
   1. Glass: ASTM C 1036, Type 1, Class 1, q3.
      a. Tint: Clear exterior lite, clear interior lite.
      b. Kind: 1/4-inch fully tempered interior lite, 5/16-inch laminated exterior lite.
   2. Lites: Two.
   3. Filling: Fill space between glass lites with air.

E. Glazing System: Manufacturer’s standard factory-glazing system that produces weathertight seal.

F. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
   1. Exposed Hardware Color and Finish: As indicated by manufacturer's designations.

G. Projected Window Hardware:
   1. Type and Style: Manufacturer’s Standard Lift-Lock Hardware.
   2. Hinges: Non-friction type, not less than two per sash.
   3. Lock: Lever handle and cam-action lock with keeper.
   4. Limit Devices: Manufacturer’s standard limit devices designed to restrict sash opening.
      a. Limit clear opening to 4 inches for ventilation; with custodial key release.

H. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

I. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Sub Sill: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

B. Integral Venetian Blinds:
   1. 5/8" wide aluminum slat blinds. Blind color shall be selected by Architect from entire product range.
   2. Blind to be integrally mounted between the dual or triple glazing.
   3. Tilt-control knob will be located on the interior face and incorporate a "slip clutch" feature.
   4. Raise and lower pull cords will be located between glass for access only when glazed access panel is opened.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

G. Limited Opening Device
   1. Provide concealed device to limit initial sash operation to 4". (Specify other limited opening as necessary.)
   2. Operation past this point to be by use of a tool or removable key.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Manufacturer Site Visit:
   1. A representative from the Window Manufacturer is to visit the jobsite for the installation of the first windows to ensure the product is being installed in accordance with the manufacturer’s recommendations and installation instructions. The Contractor shall coordinate and assist in scheduling the site visits by the Manufacturer’s Representative.

C. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

D. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 08 51 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

    a. Swinging doors.
2. Keyed Cylinders for other door types within project.
3. Knox Boxes

B. Related Sections:

1. Section 08 11 13 - "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
2. Section 08 14 16 - "Flush Wood Doors" for integral intumescent seals provided as part of labeled fire-rated assemblies.
3. Section 08 31 13 - "Access Doors and Frames" for access door hardware, except cylinders.
4. Section 08 41 13 - "Aluminum-Framed Entrances and Storefronts" for installation of entrance door hardware, except cylinders.
5. Section 28 13 00 - "Access Control" for access control devices installed at door openings and provided as part of a security system.

1.3 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's representative.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

    a. Details of interface of electrified door hardware and building safety and security systems.
    b. Schematic diagram of systems that interface with electrified door hardware.
    c. Point-to-point wiring.
    d. Risers.
    e. Elevations: doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.

D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication, and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

    a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
    b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
    c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    d. Content: Include the following information:

        1) Identification number, location, hand, fire rating, size, and material of each door and frame.
        2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
        3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
        4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
        5) Fastenings and other pertinent information.
        6) Explanation of abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for door hardware.
        8) List of related door devices specified in other Sections for each door and frame.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

B. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware schedule.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Educational Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

G. Keying Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.9 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

a. Electromagnetic Locks: Five years from date of Substantial Completion.
b. Exit Devices: Two years from date of Substantial Completion.
c. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
   b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.2 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.3 CONTINUOUS HINGES

A. Continuous Hinges: ANSI/BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

    a. Allegion plc.
    b. Hager Companies.
    c. Pemko Manufacturing Co.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Backset: 2-3/4 inches, unless otherwise indicated.

C. Lock Trim:

1. Levers: Cast.

    a. Marks USA; 195.

2. Escutcheons (Roses): Cast.
3. Dummy Trim: Match lever lock trim and escutcheons.
4. Operating Device: Lever with escutcheons (roses).

D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
3. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

E. Bored Locks: ANBSI/BHMA A156.2; Grade 1; Series 4000.

2.5 ELECTRIC STRIKES

A. Electric Strikes: ANSI/BHMA A156.31; Grade 1; with faceplate to suit lock and frame.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Von Duprin; an Ingersoll-Rand Company (VON).
b. HES; an ASSA ABLOY Group company (HES).

2.6 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: ANSI/BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Allegion plc.
b. Hager Companies..
c. Securitron Magnalock Corporation; an ASSA ABLOY Group company.

2.7 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: ANSI/BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
b. Allegion plc.
c. Don-Jo Mfg., Inc.
d. Trimco.

2.8 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Von Duprin; an Ingersoll-Rand company (VON).

2.9 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Contractor shall provide temporary construction cylinders and keying. Contract shall provide final cylinders and keying to work within WCSD Medeco keying system.

a. Exterior Doors: Provide temporary full size IC cylinders that can easily be replaced with full size IC Medeco cylinders.
b. Interior Doors: Provide temporary standard cylinders that can easily be replaced with standard Medeco cylinders.

B. Permanent Cores: Permanent Medeco key cylinders and keying will be provided and installed by Contractor.

2.10 KEYING

A. Keying System: All final and permanent Medeco key cylinders and keying will be provided and installed by Contractor.

B. Provide 400 blank keys to be cut by the Contractor. The Owner shall provide a keying schedule.

2.11 KEY CONTROL SYSTEM

A. Key Control Cabinet: ANSI/BHMA A156.5, Grade 1; recessed metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with minimum key capacity of 350, expandable to 450 minimum.

1. Recessed In-Wall Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
2. Basis-of-Design Product: Subject to compliance with requirements, provide “In Wall” recessed cabinet Model # 1305-A, manufactured by Lund Equipment Co., www.lundkey.com, Ph: 1-330-659-4800, sales@lundkeycab.net, P.O. Box 213 Bath, Ohio 44210, or approved equal.
3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.
4. Mounting height: The center of the cabinet shall be mounted at 48" A.F.F., max.

B. Key Lock Boxes: Designed for storage of a minimum of two keys.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Knox Company.
1) Knoxbox 3200, high-security key lock box.
2) Provide hinged door, ¼” plate steel housing, ½” thick steel door with interior gasket seal and stainless-steel door hinge.
3) Box and lock UL Listed: UL 1037, UL1610, UL 1332, UL 437.
4) Lock shall have 1/8” thick stainless steel dust cover with tamper seal mounting capability.
5) Recessed mounting.
6) Color: Aluminum

2.12 OPERATING TRIM

A. Operating Trim: ANSI/BHMA A156.6; stainless steel, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Allegion plc.

b. Don-Jo Mfg., Inc.
c. Trimco.

2.13 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: ANSI/BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.

B. Astragals: ANSI/BHMA A156.22.

2.14 SURFACE CLOSERS

A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. LCN; an Allegion plc brand (LCN).

2. Surface closers shall be installed on the Room-side of the doors.

2.15 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

B. Floor-Mounted Stops: Basis of Design: Ives FS 436

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allegion plc.
   b. Don-Jo Mfg., Inc.
   c. Trimco.
   d. Ives

C. Wall-Mounted Stops: Basis of Design: Ives WS402CCV

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allegion plc.
   b. Don-Jo Mfg., Inc.
   c. Trimco.
   d. Ives

2.16 DOOR GASKETING

A. Door Gasketing: ANSI/BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Pemko Manufacturing Co.
b. National Guard Products, Inc.

2.17 THRESHOLDS

A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Pemko Manufacturing Co.

2.18 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Allegion plc.
b. Don-Jo Mfg., Inc.
c. Trimco.

2.19 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Allegion plc.
b. Don-Jo Mfg., Inc.
c. Trimco.
d. Architectural Openings, PO Box 8047, Colorado Springs, Co 80907, www.IndicatorDeadbolt.com
1) Restroom Deadbolt Indicator (RDI)
2) Provide spacers with extended screws at deadbolt indicators.

2.20 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.
2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.21 FINISHES

A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in

the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
3. Fasters shall be supplied which provide adequate anchorage to the specific hardware.
4. Where the substrate will not allow adequate anchorage, appropriate through-bolts shall be used.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Closers: Mount Closers with on **non-public**, interior side of door. Contact architect for clarification. All push-side mounts to be parallel arm.
   1. Use Sex Bolts on all Wood and FRP Doors
   2. Provide Backing Plate on all Hollow Metal Doors

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

   1. Configuration: Provide one power supply for each door opening with electrified door hardware.

F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 - "Joint Sealants."

G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

   1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Contractor shall remove ALL construction door stops from the jobsite before the project can be considered Substantially Complete.

D. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

Door Hardware Set No. 01 - Classroom Intruder

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Lockset	195DB/G3	Marks	26D
2	Cylinder	20200V0(S) K 26 9C S	Medeco	US26D
1	Closer	4040XP Rw/PA	LCN	AL-689
1	Wall Bumper	WS402CCV	Ives	US26D
1	Perimeter Gasket	By Storefront Manuf.		

Door Hardware Set No. 02 – (Staff Toilet Room Doors)

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Lockset	195F-G3 Storeroom Function	Marks	26D
1*	Deadbolt	B660P (with RDI occupancy indicator)	Schlage	626
1	Coat Hook	B-983 Door Mount	Bobrick	304 Satin
1	Closer	4040XP Rw/PA	LCN	Al-689
1	Wall Bumper	WS402CV or 1CV (as req.)	Ives	US26D
1	Perimeter Gasket	By Storefront Manuf.		

*** MEDECO S4 CYLINDER**

Door Hardware Set No. 03 – (Student Toilet Room Doors -Accessible)

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1**	Deadbolt	B660P with RDI occupancy indicator (mount at lever height)	Schlage	626
1**	Deadbolt	B661P	Schlage	626
2	Door Pulls	8103-2 x Type J/N Mount Mount vertical on each side	Ives	626
1	Closer	4040XP Rw/PA	LCN	Al-689
1	Coat Hook	B-983 Door Mount	Bobrick	304 Satin
1	Wall Bumper	WS402CV or 1CV (as req.)	Ives	US26D
1	Adj. Door Bottom	SL-301	Special-Lite	
1	Perimeter Gasket	By Storefront Manuf.		

** **MEDECO S4 CYLINDER**

Door Hardware Set No. 04 – Interior Storeroom @ Aluminum Frame

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Lockset	195F/G3	Marks	26D
1	Cylinder	20200V1(S) K 26 9C S	Medeco	US26D
1	Closer	4040XP Rw/PA	LCN	AL-689
1	Wall Bumper	WS402CV or 1CV (as req.)	Ives	US26D
1	Kickdown Holder	FS452-4	Ives	US26D

Door Hardware Set No. 5 – Interior Exit HM without Access Control (Electrical Rooms)

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Exit Device	LD 99NL-OP-F	Von Duprin	US26D
1	Cylinder	33-07603V	Medeco	US26D
1	Door Pull	990NL Trim Plate	Von Duprin	US26D
1	Closer	4040XP-3077CNS	LCN	AL-689
1	Weatherstrip	316 APK	Pemko	A
1	Kickdown Holder	990NL	Von Duprin	

Door Hardware Set No. 6 – Interior Exit with Access Control

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Exit Device	CD 990NL-R/V-4	Von Duprin	US26D
1	Cylinder	33-07603V	Medeco	US26D
1	Electronic Strike	6100	Von Duprin	US26D
1	Closer	4040XP-3077CNS	LCN	AL-689
1	Perimeter Gasket	By Storefront Manuf.		

Door Hardware Set No. 7 – Exterior Exit without Access Control

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Exit Device	CD 99EO -4	Von Duprin	US26D
1	Cylinder	33-07603V	Medeco	US26D
1	Closer	4040XP-3077CNS	LCN	AL-689
1	Threshold	2748	Pemko	A
1	Adj. Door Bottom	SL-301	Special-Lite	
1	Perimeter Gasket	By Storefront Manuf.		
1*	Exterior Trim Plate	990NL	Von Duprin	US26D
1*	Wall Bumper	WS402CVX	Ives	

Door Hardware Set No. 8 - Communicating Classroom

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Cylinder	20200V0(S) K 26 9C S	Medeco	US26D
1	Lockset	195DB/G3	Marks	US26D
1	Closer	4040XP 3077CNS	LCN	AL-689
1	Wall Bumper*	WS402CCV	Ives	US26D
1	Perimeter Gasket	By Storefront Manuf.		

Door Hardware Set No. 20 – Miscellaneous Medeco Cores for other locks as required.

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Glass for storefront framing.
2. Glass for aluminum windows
3. Glazing sealants and accessories.
4. PVC glazing films.

B. Related Requirements:
1. Section 01 43 39 – “Classroom Mockup”
2. Section 08 17 43 - “Flush FRP Doors” for glazing in flush FRP doors.
3. Section 08 41 13 - "Aluminum Framed Entrances and Storefronts."
4. Section 08 88 53 - "Security Glazing."
5. Section 08 51 13 - "Aluminum Windows" for glazing in Aluminum Windows.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products: 12 inches square.

1. Laminated glass.
2. Insulating glass.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Preconstruction adhesion and compatibility test report.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

A. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 08 41 13 - "Aluminum-Framed Entrances and Storefronts" and Section 08 51 13 - "Aluminum Windows" to match glazing systems required for Project, including glazing methods.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Glazing Film: Follow International Window Film Association (IWFA) guidelines for Architectural Visual Inspection Standard for Applied Window Film.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:

1. Guardian Glass; SunGuard.
2. Oldcastle Building Envelope™.
3. Viracon, Inc.
4. Citadel Architectural Products, Inc.
5. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

1. Obtain tinted glass from single source from single manufacturer.
2. Obtain reflective-coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE 7-16, based on heights above grade indicated on Drawings.

    a. Wind Design Data: As indicated on Drawings.
    b. Basic Wind Speed: 130 mph (Ultimate).
    c. Risk Category: III.
    d. Exposure Category: C.
    e. Ground Elevation Factor, K_e: 1.0
3.

4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic glass lites, properties are based on units with lites 6 mm thick.
2. For laminated glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.
7. Optical Distortion Limits:
    a. Maximum peak-to-valley roll wave 0.005 inch in the central area of the glass lite excluding the leading and trailing 12 inches.
    b. Maximum localized and overall bow (warp) per lite shall each be one-half of maximum allowed by ASTM C1048.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements, but not less than 0.060 inch.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Aluminum with black, color anodic finish.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

B. Translucent Insulating-Glass Units (G10): Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Aluminum with black, color anodic finish.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.
4. 1” insulated assembly:
   a. ¼ Tempered glass with Low-E coating on #2 surface
   b. 5/16” airspace – Black aluminum
   c. 3/16” clear tempered glass
   d. 3/16” translucent white

2.7 EXTERIOR INSULATING OPAQUE COMPOSITE PANELS – G6

A. Water Resistant Opaque Glazing Panels

1. Manufacturer: Citadel Architectural Products, Inc., or equal.
2. Prefinished Smooth Aluminum Skins.024” (min).
3. High Density Polypropylene Stabilizers 5/32”
4. Polyisocyanurate Foam ISO Core 5/8”
5. Panel Weight: 1.05 lbs/s.f.
6. Nominal Thickness: 1”
7. Exterior Aluminum Skin Finish: Class 1 Clear Anodized
8. Interior Finish: Standard- Plus Kynar 500 or Premium Kynar 500

   a. Color: As selected by Architect from Manufacturer’s full range.

2.8 INTERIOR INSULATING OPAQUE COMPOSITE PANELS – G7 & G8

A. Water Resistant Opaque Glazing Panels

1. Manufacturer: Citadel Architectural Products, Inc., or equal.
2. Prefinished Smooth Aluminum Skins.024” (min).
3. High Density Polypropylene Stabilizers 5/32”
4. Polyisocyanurate Foam ISO Core 5/8”
5. Panel Weight: 1.05 lbs/s.f.
6. Nominal Thickness: 1”
7. Aluminum Skin: Class 1
8. Interior and Exterior Finish: Standard- Plus Kynar 500 or Premium Kynar 500

   a. Color: As selected by Architect from Manufacturer’s full range.

2.9 MANUAL INTEGRAL HORIZONTAL BLIND LITES AT DOORS: (Doors B104A, B104B, B104C, B104D, B116A, B116B, B124, B125, B126A, B126B, C135) – G9

1. Provide manufactures microblinds and accessories at doors indicated on Door Schedule.

   a. Basis-of-Design Product: Subject to compliance with requirements, provide Pariluse LLC; IE Blinds or comparable product by one of the following:

      1) ODL

2) Thermat-Tru Corp.
3) Unicel Architectural

2. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.
3. Glazed integral blind units to be sealed at perimeter.
4. Integral blind units to be assembled and integrated with tempered and laminated glazing.
5. Controls: Single side direct drive.
6. Color: to be selected by Architect from manufactures full range.

2.10 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Field-applied sealants shall have a VOC content of not more than 250 g/L.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; Dow Corning® 790 Silicone Building Sealant.
b. Pecora Corporation; 890NST.
c. Sika Corporation; SikaSil WS-290.
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.11 NON-ADHESIVE BANNER PERFORATED PVC GLAZING FILMS - GF

A. Double-sided, non-scrim, opaque perforated PVC banner without release liner with a block out layer in the middle to provide a high degree of opacity.

1. Composition: High-opacity white/white PVC composite film with a center block out layer.
2. Open area: 40% (approx.)
3. Vinyl Thickness: 12 mils.
4. Perforation Diameter: 062 in., approx.
5. Image: Custom: As selected and supplied digitally by Architect.
6. Locations: As indicated on Drawings.
   a. Glazing films shall be installed on the inside surface (room side) of the assembly.

B. See 08 80 01 – “GLAZING SUPPLEMENT” for window graphics.

2.12 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers:
1. Types recommended by sealant or gasket manufacturer.
2. Types recommended by PVC film manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.13 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. PVC Film: Examine glass surfaces to receive film and confirm surfaces are ready to accept the film application.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

C. Clean glazing receiving PVC film following manufacturer's recommendations.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior, or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 GLAZING FILM

A. Install glazing films following manufacturer's installation instructions.

B. Install glazing films such that the edges are within 1/16” maximum of the frame edge and are cut neatly in a straight line, parallel to the frame edge.

C. Apply ½” wide 3M 471 Clear Vinyl Tape to perimeter edge of each glazing film panel.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

E. Protect glazing films from damage until the Work has been accepted by the Owner.

3.7 INSULATING-LAMINATED-GLASS SCHEDULE

A. Glass Type **G1**: Low-E-coated, clear insulating laminated glass.

1. Basis-of-Design Product: Solarban 60 Solar Control Low-E Glass by Vitro Architectural Glass.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Tinted fully tempered float glass.
5. Tint Color: Solexia.
6. Interspace Content: Air.
7. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
   a. Minimum Thickness of Each Glass Ply: 3 mm.
   b. Interlayer Thickness: 0.060 inch.
8. Low-E Coating: Sputtered on second surface.
9. Winter Nighttime U-Factor: 0.32 maximum.
10. Visible Light Transmittance: 61 percent minimum.
11. Solar Heat Gain Coefficient: 0.27 maximum.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type - **G4**: Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

3.9 OPAQUE PANEL GLAZING SCHEDULE

A. Panel Type - **G6**: Exterior Insulating Opaque Composite Panel

1. Minimum Thickness: 1 inch.

3.10 OPAQUE PANEL GLAZING SCHEDULE

A. Panel Type - **G7**: Interior Insulating Opaque Composite Panel - Color 1

1. Minimum Thickness: 1 inch.

3.11 OPAQUE PANEL GLAZING SCHEDULE

A. Panel Type - **G8**: Interior Insulating Opaque Composite Panel - Color 2

1. Minimum Thickness: 1 inch.

3.12 MANUAL INTEGRAL HORIZONTAL BLIND LITES AT DOORS – see Specification Sections 08 11 13 Hollow Metal Doors and Frames, 08 14 16 – “Flush Wood Doors”, and 08 17 43 – “Flush FRP Doors”.

A. Panel Type - **G9**: Glazing with Integral Manual Blind

END OF SECTION 08 80 00

SECTION 08 88 53 - SECURITY GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Security Glazing at Storefront openings & FRP Doors.
2. Security glazing at the Transaction Window.

B. Related Sections:

1. Section 08 41 13 - "Aluminum-Framed Entrances and Storefronts” for security glazing within storefronts.
2. Section 08 51 13 - "Aluminum Windows” for factory installed security glazing within window units.

1.3 DEFINITIONS

A. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.

B. Interspace: Space between lites of air-gap security glazing or insulating security glazing.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Security Glazing Samples: For each type of security glazing; 12 inches square.

C. Delegated-Design Submittal: For security glazing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of product indicated, from manufacturer.

B. Product Test Reports: For each type of security glazing, for tests performed by a qualified testing agency.

C. Product Test Reports: For each type of glazing sealant, for tests performed by a qualified testing agency.

1. Provide test reports based on testing current sealant formulations within previous 36-month period.

D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Retain option in "Manufacturer Qualifications for Insulating Security Glazing Units with Sputter-Coated, Low-E Coatings" Paragraph below only if products listed in Part 2 for sputter-coated, low-e-coated, insulating glazing units are those of manufacturers with a certified fabricator program.

B. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.

C. Security Glazing Testing Agency Qualifications: Subject to compliance with requirements, testing agency is one of the following:

1. H. P. White Laboratory, Inc.
2. Underwriters Laboratories, Inc.
3. Wiss, Janney, Elstner Associates, Inc.

D. Sealant Testing Agency Qualifications: Qualified according to ASTM C 1021 for testing indicated.

1.1 MOCKUPS

A. Build mockups to set quality standards for materials and execution and to set quality standards for fabrication and installation.

1. See Section 01 43 39 – “Classroom Mockup”.
1. Install security glazing in mockups specified in Section 08 41 13 - "Aluminum-Framed Entrances and Storefronts" and Section 08 51 13- “Aluminum Windows" to match glazing systems required for Project, including glazing methods.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each security glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing will not be required if data based on previous testing of current sealant products and glazing materials match those submitted.
2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to security glazing, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating security glazing and with air-gap security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated Glass: Manufacturer agrees to replace coated glass that deteriorates within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glazing Sealants and Gaskets: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General:

1. Installed security glazing shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing; or other defects in construction.
2. Installed security glazing shall withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements, "Section 01400 "Quality Requirements," to design security glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated.

1. Design Procedure for Glass: ASTM E 1300 and ICC's International Building Code.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F , material surfaces.

E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 SECURITY GLAZING, GENERAL

A. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

C. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council or manufacturer. Label shall indicate manufacturer's name, type of glazing, glass thickness, and safety glazing standard with which glazing complies.

D. Fire-Test-Response Characteristics of Polycarbonate Sheets: As determined by testing polycarbonate sheets identical to those used in security glazing products by a qualified testing agency acceptable to authorities having jurisdiction.

1. Self-ignition temperature of 650 deg F or more when tested according to ASTM D1929 on plastic sheets in thicknesses indicated for the Work.
2. Smoke-Developed Index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested according to ASTM D2843 on plastic sheets in thicknesses indicated for the Work.

3. Burning extent of 1 inch or less when tested according to ASTM D635 at a nominal thickness of 0.060 inch or thickness indicated for the Work.

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
2. Interlayer Color: Clear unless otherwise indicated.

2.6 POLYCARBONATE SECURITY GLAZING

A. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on exposed surfaces and Type I, standard, UV-stabilized polycarbonate where no surfaces are exposed.

B. Laminated Polycarbonate: Polycarbonate sheets laminated with clear urethane interlayer that complies with ASTM C1349, Appendix X2, and has a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide laminated units that comply with requirements of ASTM C1349 for maximum allowable laminating process blemishes and haze.

C. Glass-Clad Polycarbonate: ASTM C1349.

D. Laminated Glass and Polycarbonate: ASTM C1349.

2.7 SPALL-RESISTANT FILM

A. Spall-Resistant Film: Composite of clear polyvinyl butyral film and clear abrasion-resistant polyester film.

B. Laminating Process: Factory laminate spall-resistant film to glazing assemblies to produce laminated lites free of foreign substances, air, and glass pockets.

2.8 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Field-applied sealants shall have a VOC content of 250 g/L or less.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; Dow Corning® 790 Silicone Building Sealant.
b. Pecora Corporation; 890NST.
c. Sika Corporation; SikaSil-C990.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit security glazing lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF SECURITY GLAZING

A. Fabricate security glazing in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of

product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Grind smooth and polish exposed security glazing edges and corners.

2.11 LAMINATED-GLASS-AND-POLYCARBONATE SECURITY GLAZING

A. Security Glazing **G3**: Nonsymmetrical clear laminated glass and polycarbonate with glass plies on both the attack or threat side and on the witness side.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Total Security Solutions; 1 3/16" LP Laminated TSS003 LS or equal.

2. Ballistic Resistance: Level 3 according to UL 752.

3. Forced Entry Rating: H.P. White TP-0500.01 Level I
4. Maximum Overall Unit Thickness: 1 3/16 inch.
5. Makeup:

THREAT SIDE
a. Layer 1: 3/8-inch Glass
b. Layer 2 .03-inch Urethane
c. Layer 3: 3/8-inch Glass
d. Layer 4: .05-inch Urethane
e. Layer 5: 1/8-inch Mar Resistant Polycarbonate.
f. Layer 6: .05-inch Urethane.
g. Layer 7: 3/16” Glass
SECURE SIDE

6. Provide safety glazing labeling.
SECURE SIDE

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing for security glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Minimum required bite.
5. Effective sealing between joints of framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.

F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.

H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket securely in place between glazing unit and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center security glazing in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center security glazing in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial washaway from security glazing.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing

manufacturer. Remove and replace security glazing that cannot be cleaned without damage.

C. Wash security glazing on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

END OF SECTION 08 88 53

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. Section 05 40 00 - "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For firestop tracks; submit evaluation reports certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 accreditation criteria for inspection agencies, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or similar organization providing a verifiable code-compliance program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Design framing systems in accordance with AISI S220, unless otherwise indicated

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated.
2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40 (Z120), hot-dip galvanized, or coating with equivalent corrosion resistance, unless otherwise indicated. Galvannealed products are unacceptable.
    a. Coating to demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Studs and Track: AISI S220. Use either steel studs and tracks or steel studs and tracks of equivalent minimum base-steel thickness.

1. Steel Studs and Track:

    a. Minimum Base-Steel Thickness: As indicated on Drawings.
    b. Depth: As indicated on Drawings.

2. High-Strength Steel Studs and Track:

    a. Minimum Base-Steel Thickness: As indicated on Drawings.
    b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Track System: Top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Track System: Top track, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction fit inside inner track.
3. Slotted Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Backing Plate: Proprietary fire-retardant-treated wood blocking and bracing in width indicated.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: As indicated on Drawings.

G. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: AISI S220.

1. Minimum Base-Steel Thickness: As indicated on Drawings.
2. Depth: As indicated on Drawings.

I. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.053 inch and minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch base-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Track: AISI S220.

a. Minimum Base-Steel Thickness: As indicated on Drawings.
b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: AISI S220, 7/8 inch deep.

a. Minimum Base-Steel Thickness: As indicated on Drawings.

4. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical or hat shaped.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

a. L-Shaped Clips as required to support metal framing from masonry thru rigid insulation.

b. Other miscellaneous clips as required.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance- rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. Gypsum Association document GA-216- Current Edition, *Application and Finishing of Gypsum Board.*

B. ASTM C 840, *Standard Specification for Application and Finishing of Gypsum Board*

1.3 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Fiber-reinforced cementitious backer board.

B. Related Requirements:

1. Section 06 16 00 - "Sheathing" for gypsum sheathing for exterior walls.
2. Section 07 92 00 - "Joint Sealants".
3. Section 09 22 16 - "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
4. Section 09 91 23 - "Interior Painting" for painting of gypsum board surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTME 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Georgia-Pacific
2. National Gypsum Company
3. USG Corporation

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

2.4 CEMENTITIOUS BACKER BOARD

A. Fiber-Cement Backer Board: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: 5/8 inch.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet**; vinyl, PVC-based composite;** or rolled zinc.
2. Shapes:
   a. Cornerbead - provide at all outside corners, typical.
   b. LC-Bead: J-shaped; - provide as shown on the drawings, exposed long flange receives joint compound.
   c. L-Bead: L-shaped; - provide at all gypsum board ends butted to other material, typical, long flange receives joint compound.
      1) Contractor may utilize Trim-Tex PVC Tear Away L Bead, or equal, at his option.
3. Gypsum Board Reveal Trim at STEAM Lab B101 and Toilet Rooms Resinous Wainscot transition to be Fry Reglet DCS-625-75 Aluminum or equal. Provide Fry Reglet end caps at the open end of each segment.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C1002, unless otherwise indicated.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

1. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated.
2. Type X: Vertical surfaces unless otherwise indicated.
3. Abuse-Resistant Type: As indicated on Drawings.
4. Moisture- and Mold-Resistant Type: As indicated on Drawings.
5. Install gypsum panel products applied to walls with the bottom edge spaced a minimum of ¼" above the floor
    a. At floor conditions where gypsum board walls abut or return to door or window frames, the gypsum panels shall extend to the floor. See typical architectural details.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
3. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim: Install in the following locations:
1. Cornerbead - provide at all outside corners, typical.
2. LC-Bead: J-shaped; - provide as shown on the drawings, exposed long flange receives joint compound.
3. L-Bead: L-shaped; - provide at all gypsum board ends butted to other material, typical, long flange receives joint compound.
   a. Contractor may utilize Trim-Tex PVC Tear Away L Bead, or equal, at his option.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as

not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C
840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 3 with Spatter or Heavy Orange Peel texture: At panel surfaces that will be exposed to view in service areas (Mechanical, electrical, telecommunications rooms, storage rooms, etc.) unless otherwise indicated.
3. Level 4 with Light Orange Peel texture: At panel surfaces that will be exposed to view which are accessible to the public (Kitchens, classrooms, corridors, stairs, administration areas, offices, workrooms, toilet rooms, etc.) unless otherwise indicated.
4. Primer and its application to surfaces are specified in Section 09 91 23 - "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 35 43 POLISHED CONCRETE FINISH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Specification Section 03 34 50 – “Concrete Finishing”, for tolerances for concrete floor finish & flatness requirements.

1.2 SUMMARY

A. Section Includes: Products and procedures for coloring and bonded abrasive polishing concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.

1.3 DEFINITIONS

A. Terminology: As defined by the Concrete Polishing Council (CPC), a specialty council of the American Society of Concrete Contractors.

B. Polished Concrete: The act of changing a concrete floor surface, with or without aggregate exposure, to achieve a specified level of gloss.

C. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, polishing of a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of finished gloss as defined by the CPC. This yields the most durable finish and requires the least amount of maintenance.

1.4 STANDARDS

A. ASTM 5767 - Standard Test Method for Instrumental Measurement of Distinctness- of-Image Gloss of Coating Surfaces

B. ASTM D523 – Standard Test Method for Specular Gloss

C. ANSI A326.3-2017 (Dynamic Coefficient Friction of Hard Surface Flooring)

D. DIN EN ISO 4287 - Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters.

E. CSDA-ST-115 - Measuring Concrete Micro Surface Texture.

F. Other references:

1. CPC Appearance Chart and Aggregate Exposure Chart for polished concrete, as defined by the Concrete Polishing Council (CPC), a specialty council of the American Society of Concrete Contractors (ASCC)

1.5 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.

B. Samples for Initial Selection: For each type of product requiring color selection.

C. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 "Quality Assurance" Article.

D. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Applicator/Polisher Qualifications:

1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work. Minimum 2 years documented experience in work of this Section.
2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress.
3. Manufacturer Qualification: Requires letter of recommendation from polishing system manufacturer. Approved by manufacturer to apply liquid applied products.

B. Mockups: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing.

1. Size: Minimum 100 square feet for each color and finish at location adjacent to floor that will receive polish, but will be covered with another flooring material.
2. Show requested polished finish.
3. Test aggregate to ensure it will accept polish.
4. Include control joints and edges.
5. Approved mockups may not remain as part of the Work.
6. Mockup to meet or exceed Gloss Rating, DOI and RA requirements
7. Minimum Gloss Rating (GU) of 30 at 60 degrees.

8. Minimum DOI of 30 after the application of Concrete Hardener prior to application of Sealer
9. Maximum RA of 40 micro inches or less.
10. Obtain Architect's approval before starting work on Project.

C. Coefficient of Friction: Minimum 0.43, tested to ANSI/NFSI B101.3 after polishing.

E. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
1. Required Attendees:
   a. Owner.
   b. Architect.
   c. Contractor, including supervisor.
   d. Concrete producer.
   e. Concrete finisher, including supervisor.
   f. Concrete polisher, including supervisor.
   g. Technical representative of liquid applied product manufacturers.
2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
   a. Tour field mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
   b. Review Contract Document requirements.
   c. Review approved submittals and field mock-up.
   d. Review procedures, including, but not limited to:

      1) Applicable Division 03 Section on cast-in-place concrete
         a) Specific mix design.
         b) Specified curing methods/procedures.
         c) Projected 3-, 10-, and 28-day compression strength test related to specified aggregates exposure for finished floor and project phasing.
         d) Protection of concrete substrate during construction and prior to polishing process.

      2) Project phasing and scheduling for each step of grinding, honing and polishing operations including, but not limited to:
         a) Quality of qualified personnel committed to project.
         b) Quality and size of grinders committed to project.
         c) Proper disposal of concrete slurry and/or concrete dust.

      3) Details of each step of grinding, honing, and polishing operations.
         b) Application of liquid applied products (Densifier).
         c) Protecting polished concrete floors after polishing work is complete.

F. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.7 FIELD CONDITIONS

A. Protect concrete surfaces scheduled to receive polished finish after concrete placement but prior to polishing; prevent damage and staining:
1. Prohibit vehicular traffic on surfaces to be polished.
2. All equipment must be equipped with non-marking tires.

3. Diaper all hydraulic equipment.
4. Prohibit pipe cutting operations on surfaces to be polished.
5. Prohibit storage on surfaces to be polished for minimum 28 days after concrete placement.
6. Prohibit ferrous metals storage on surfaces to be polished.
7. Prevent liquid drippings from equipment on surfaces to be polished.
8. Prevent acids and acidic detergents from contacting surfaces to be polished.
9. Prevent painting over surfaces to be polished.

B. Comply with chemical manufacturer's requirement for ambient and surface temperature and humidity ranges before, during, and after application.

C. Close areas to traffic during finishing and for minimum time period after finishing as recommended by chemical manufacturer.

D. Concrete: Cured minimum 28 days or to which point where equipment can operate on slab without displacing aggregate.

1.8 SCHEDULING

A. Schedule polishing minimum 21 days prior to fixture and trim installation

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original containers, with seal's unbroken, bearing manufacturer labels indicating brand name and directions for storage.

B. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers.

C. Store materials in a clean, dry area in accordance with manufacturer's instructions.

D. Keep products from freezing.

1.10 PROJECT CONDITIONS

A. Environmental limitations:

1. Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.

    a. Specified overall values of flatness, F(F) 50: and of levelness, F(L) 30; with minimum local values of flatness F(F) 35; and of levelness, F(L) 20.
    b. Concrete must be cured a minimum of 45 days or as directed by the manufacturer before application of special floor finish hardening/sealing agent can begin.

c. Application of special floor finish hardening/sealing agent shall take place 10 days prior to installation of equipment and substantial completion, thus providing a complete, uninhibited concrete slab for application.

2. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Husqvarna SUPERFLOOR Concrete Polishing Systems.
Contact: Ryan Atkinson; Architectural Specifier, Mobile: (470) 612-9010,
ryan.atkinson@husqvarnagroup.com

B. Ensure Concrete finishing compounds and repair materials are from a single source manufacture for Proprietary Products/Systems.

2.2 MATERIALS

A. Concrete Dye: No Dye or Stains to be included.

B. Concrete Hardener
1. Type: Neutral pH, Colorless, penetrating produced specifically for sealing and hardening concrete surfaces
2. Product: Husqvarna SUPERFLOOR Treatments including CURE Densifier & Hardener
3. Maximum volatile organic compound (VOC) content: <50 grams per liter

C. Topical Sealer:
1. Type: Milky white, penetrating product produced specifically for creating a hydrophobic and high stain resistance finish for stained or polished concrete surfaces.
2. Product: Husqvarna SUPERFLOOR Treatments including PREMIUM GUARD
3. Maximum volatile organic compound (VOC) content: <50 grams per liter.

D. Hydrophobic Sealer (at Multi-purpose Room):
1. Type: Milky white, semi-penetrating product produced specifically for creating a topical hydrophobic and high stain resistance finish for stained or polished concrete surfaces.
2. Product: Husqvarna SUPERFLOOR Treatments including TOPICAL GUARD
3. Maximum volatile organic compound (VOC) content: <50 grams per liter.

E. Repair Materials:

1. Small gouges in concrete should be repaired with Polyurea, Color: Clear, prior to polish process.

2. Patching Material:

a. Basis of Design Source: HI-TECH Systems, Ontario, CA, (800) 454-5530, www.hitechpolyurea.com.
b. Product: HTS Chemical PE-85, Color: clear
c. Maximum volatile organic compound (VOC) content: <50 grams per liter.

F. Grout Material
   a. Basis of Design Source: Husqvarna SUPERFLOOR Treatments. Olathe, KS, (800) 288-5040, www.husqvarnaconstruction.com
   b. Type: Acrylic grout material.
   c. Product: Husqvarna GM 3000
   d. Maximum volatile organic compound (VOC) content: <50 grams per liter.
   e. For repairs/grout coat. Apply over entire polished floor.

G. Diamond tools required for Heavy Aggregate, Class C Finish:
   a. Metal bonded; 20 Grit Gold, 50 Grit Brown.
   b. Resin bonded: 50 semi-metal (Brown), 100 resin (Black), 200 resin (Blue), 400 resin (Red).

H. Grinding Pads for Edges:
   a. Use necessary steps to remove trowel marks, discoloration and other flaws near wall lines. Some irregularities may remain, but should be brought to the attention of owner architect for review if question of consistency or desired finish.

I. Joint Fill Material
   1. Basis of Design Source: HI-TECH Systems, Ontario, CA, (800) 454-5530 www.hitechpolyurea.com.
   2. Type: Fast setting chemical resistant Polyurea.
   3. Product: HTS Chemical PE-85, Color: Clear
   4. Maximum volatile organic compound (VOC) content: <55 grams per liter.

2.3 ACCESSORIES

A. Cleaning Products: Non-corrosive, neutral pH. Husqvarna SUPERFLOOR Treatments including CLEAN & PROTECT recommended to clean and maintain for after care.

2.4 EQUIPMENT

A. Polishing Equipment:
   1. Three or four head dual-drive, counter-rotating, or planetary variable speed approved floor grinder with minimum 600 pounds down pressure.
   2. Hand grinder with dust extraction attachment and pads.

B. Vacuum Equipment:
   1. Approved dust extraction system, pre-separator, and squeegee attachments to comply with OSHA Crystalline Silica Standard for Construction under 29 CFR 1926.1153

C. Auto Scrubber with soft disk style brushes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine concrete substrates for conditions affecting performance of finish.

B. Repairs not acceptable unless approved by Architect or General Contractor.

C. Verify that concrete substrate meets finish and surface profile requirements.

D. Ensure that concrete is sufficiently cured to accept polishing.

3.2 PREPARATION

A. Testing Concrete Floors:
   1. Alkalinity:
      a. Test method: Measure pH according to ASTM F710.
      b. Acceptable results: pH above 9.
   2. Moisture Vapor Transmission:
      a. Test method: Perform anhydrous calcium chloride test to ASTM F1869.
      b. Acceptable results: Maximum 5 pounds per 1000 square feet in 24 hours.
   3. Relative humidity:
      a. Test method: Perform relative humidity test using in situ probes to ASTM F2170.
      b. Acceptable results: Maximum 75 percent.
   4. Surface Texture
      a. Calibrate Profilometer and record surface texture per CSDA ST118.

B. Clean surfaces of loose and foreign materials and debris.

C. Protect adjacent surfaces from damage.

3.3 POLISHING

A. Initial Grinding:

1. Identify high spots or areas in concrete, wall edges, etc. that may require additional grinding where aggregate may be exposed.
2. Select appropriate tool and process to achieve desired results.
3. Remove construction debris and floor slab imperfections until uniform scratch pattern and desired concrete aggregate exposure is achieved using appropriate tools, and manufactures instruction.
4. Achieve maximum refinement as per ST 115 or polishing system manufacturer before proceeding to next tool.
5. Clean floor using auto scrubber vacuum with brushes after each pass.

B. Treating Surface Imperfections:

1. Mix patching compound and grout material by using HTS Chemical “Spall TX3” or equal, to match color of adjacent concrete surface.

2. Fill surface imperfections prior to polishing. If surface residues exist, expose repair areas by a removal pass over floor first.

3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not noticeable when viewed from 10 feet away under

lighting conditions that will be present after construction.

C. Surface Grouting: Apply Husqvarna GM 3000 to entire floor for a cementitious grout coat onto surface to fill voids, to [match] color of concrete using grout pans on machine to work material into the pours. Allow to cure minimum of 6 hours to overnight.

D. Honing:
1. Grind surfaces to within 2 - 3 inches of walls with semi metal and resin bonded diamond pads of 100, 200 grit, grinding 90 degrees from each previous grind.
2. Grind edges with appropriate tool per ST115 and tools capacity.
3. Remove scratches and achieve maximum refinement with each pass before proceeding to finer grit pads.
4. Vacuum floor using squeegee vacuum attachment after each pass.

E. Polishing:
1. Apply undiluted Husqvarna SUPERFLOOR CURE densifier/hardener at rate of 400 to 600 square feet per gallon.
   a. Allow to stand on surface for 10 minutes, then reapply to areas where densifier/hardener has soaked in and allow to stand for an additional 20 minutes.
   b. Allow material to dry.
   c. Do not remove excess densifier/hardener from floor.
2. Use polishing equipment with resin bonded polishing and burnishing pads.
3. Begin polishing in one direction starting with appropriate tool as required to achieve specified surface finish.
4. Polish edges first, then field of floor.
5. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass.
6. Achieve maximum refinement with each pass before proceeding to finer grit pads.
7. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
8. Continue polishing until gloss appearance, as measured according to ASTM E430, matches approved mockup.

3.4 SEALING

A. Apply sealer to manufacturer’s recommend coverage, roughly 1,000 square feet fer gallon.

B. Remove excessive sealer.

C. Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mockup.

3.5 PROTECTION

A. Close areas to traffic until concrete treatment has cured.

B. Protect completed work with non-staining sheet coverings until just prior to Substantial Completion.

3.6 CONCRETE POLISHING SCHEDULE

A. Sheen:
1. CPC Level 2
2. Satin/Honed, DOI greater than 30, Gloss Units (GU) greater than 30, RA less than 40.

B. Aggregate Exposure:
1. CPC Heavy Aggregate Class C

C. OVERALL FLOOR DESIGN
1. CPC C2



END OF SECTION 09 35 43

SECTION 09 51 23 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Acoustical panels for ceilings.
   2. Suspension systems.

B. Related Requirements:
   1.
   2. Section 21 13 00 - “Fire Suppression Sprinkler Systems” for penetrations in acoustical panel ceilings.
   3. Section 23 37 00 - “Air Outlets and Inlets” for HVAC registers in acoustical panel ceilings.
   4. Section 26 51 00 - “Interior Lighting” for light fixtures in acoustical panel ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6-inches- in size.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: 12 Full-size panels.

1.6 QUALITY ASSURANCE

A. Mockups: Saee section 01 43 39 – Classroom Mockup

B. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical ceiling area as indicated on Drawings.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product

designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS TYPE 1

A. Available Manufacturers: Subject to compliance with requirements, available manufacturers include, but are not limited to, the following:
   1. Armstrong World Industries, Inc. – Mesa 683
   2. USG Interiors, Inc.
   3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Classification: Provide panels complying with ASTM E1264 for type, form, and pattern as follows:
   1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
   2. Pattern: CE (perforated, small holes and medium texture).
   3. Color: White.
   4. Edge/Joint Detail: Square
   5. Thickness: 3/4 inch.
   6. Size: 24 inches by 48 inches.
   7. NRC: 0.60
   8. CAC: 33
   9. Class A
   10. Light Reflectance: 0.85

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C635/C635M.

B. Attachment Devices: Size five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.135-inch- diameter wire.

D. Seismic Struts: Manufacturer’s +standard compression struts designed to accommodate lateral forces.

E. Seismic Clips: Manufacturer’s standard seismic clips designed and spaced to secure acoustical panels in-place.

2.5 METAL SUSPENSION SYSTEM

A. Products: Subject to compliance with requirements, available products include, but are not limited to, the following:
   1. Armstrong World Industries, Inc. – Standard Prelude 15/16”

2. USG Interiors, Inc.; - Donn DXW 15/16”
3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A653/A653M, G30 coating designation.
1. Structural Classification: Intermediate-duty system.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. Provide Shadow Reveal edge moldings where shown on Drawings. Armstrong Shadow Molding 7878 or equal.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 FINISHES

A. All products shall be “0 (Zero) Lead”, utilizing the lead safe work practices identified in the EPA Guidance Document titled “Steps to Lead Safe Renovation, Repair and Painting”, pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 775-851-5675.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL PANEL CEILINGS

A. General: Install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   6. Do not attach hangers to steel deck tabs.
   7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
   9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical panel ceiling area and where necessary to conceal edges of acoustical panels.
   1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
   2. Do not use exposed fasteners, including pop rivets, shall match color on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical panels as follows:
   1. As indicated on reflected ceiling plans.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace panels and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rubber base.
2. Rubber molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE - B1

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
2. Johnsonite; a Tarkett company.
3. Roppe Corporation, USA.
4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

a. Style B, Cove: As indicated on Drawings.

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: 100’ coil.

F. Outside Corners: Field formed

G. Inside Corners: Field formed

H. Colors: As selected by Architect from full range of industry colors.

2.2 RUBBER STAIR ACCESSORIES

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Johnsonite: A Tarkett company
2. Nora Systems, Inc.
3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Stair Treads: ASTM F2169.

1. Type: TS (rubber, vulcanized thermoset).
2. Class: 2 (pattern; embossed, grooved, or ribbed).
3. Group: 1 (embedded abrasive strips).
4. Nosing Style: Square.
5. Nosing Height: 1-1/2 inches.
6. Thickness: 1/4 inch and tapered to back edge.
7. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
8. Integral Risers: Smooth, flat; in height that fully covers substrate.

D. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 RUBBER MOLDING ACCESSORY

A. Description: Rubber carpet edge for glue-down applications.

B. Profile and Dimensions: As indicated.

C. Locations:
1. At exposed carpet edges that meet Polished Concrete floors.
   a. Johnsonite EG-XX-G Double Undercut or equal.
2. At exposed carpet edges that meet Resinous Flooring.
   a. Johnsonite CTA-XX-D Molding or equal.
3. At exposed rubber tile or rubber stair tread edges that meet Polished Concrete floors.
   a. Johnsonite CD-XX-T Molding or equal.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 VINYL STAIR MOLDING ACCESSORY (Student Hub Risers)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring
3. Johnsonite. a Tarkett company
4. Roppe Corporation, USA

5. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Description: Vinyl stair-tread nosing.

C. Profile and Dimensions: Johnsonite SVCD-XXX-A or equal.

D. Locations: At Bench Platforms in Student Hub 1 C129.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RUBBER BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply rubber base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install rubber base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere rubber base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch rubber base during installation.

F. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Rubber Stair Accessories:

1. Tightly adhere to substrates throughout length of each piece.
2. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 67 23 - RESINOUS FLOORING & WAINSCOT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Methyl Methacrylate (MMA) acrylic floor coating system.
2. Transition strips between unrelated flooring surfaces (if required)

B. Related Requirements
1.
2. Section 09 65 13 - “Resilient Base and Accessories” for transition strips between resinous flooring and resilient flooring – if required.
3. Section 09 29 00 – “Gypsum Board” for substrates for MMA.

1.3 REFERENCE STANDARDS

A. ACI 308 - Standard Practice for Curing Concrete (if applicable)

B. ACI 302.1R-80 - Guide for Concrete Floor and Slab Construction (if applicable)

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
2. The agenda shall include a review and clarification of this specification, application procedures, quality control, inspection and acceptance criteria, and production schedules.
3. Review details of integral cove bases.
4. Review manufacturer's written instructions for installing resinous flooring systems.
5. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.
6. Applicator is NOT authorized to proceed until this meeting is held or waived by Owner.
7.

1.5 SUBMITTALS

A. Acceptance Sample: One foot square (1 ft. by 1 ft.) sample of the specified acrylic flooring system applied to hardboard or similar backing for rigidity and ease of handling.

B. Manufacturer's Literature: Descriptive data and specific recommendations for surface preparation, mixing, and application of materials.

C. Manufacturer's Material Safety Data Sheets (MSDS) for each respective product to be used.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Must have a minimum of 10 years of experience manufacturing methyl methacrylate systems (MMA).

B. All products shall be “0 (Zero) Lead”, utilizing the lead safe work practices identified in the EPA Guidance Document titled “Steps to Lead Safe Renovation, Repair and Painting”, pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.

C. Applicator Qualifications:
1. Pre-qualification requirements: Each bidder for this project shall be prequalified and approved by the material Manufacturer at the time of bid submittal.
2. Each approved applicator shall have been trained by the Manufacturer in all phases of surface preparation and application of the specified flooring system(s).
3. Each approved applicator must have five (5) years of experience of installing the specified flooring system and submit a list of five (5) projects/references of equal size, quantity, and magnitude to this Project as a prequalification requirement.

D. Acceptance Sample:
1. A minimum one-foot square representative sample of the specified flooring system shall be prepared by the Manufacturer's representative and submitted to the Owner during the submittal process.
2. The installed flooring system shall be similar to the acceptance sample in thicknesses of respective film layers, color, texture, overall appearance and finish.

E. Bond Testing:
1. Surface preparation efforts shall be evaluated by conducting Bond Tests at the site prior to application of the flooring system(s).
2. See paragraph 3.03 - B or consult with Material Manufacturer for specific procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. All material shall be delivered in original Manufacturer's sealed containers with all pertinent labels intact and legible.

B. Store materials in dry protected area between 25° and 80° Fahrenheit. Keep out of direct sunlight. Protect from open flame; keep all containers grounded.

C. Follow all Manufacturer's specific label instructions and prudent safety practices for storage and handling.

1.8 PROJECT CONDITIONS

A. Material, air, and surface temperatures shall be in the range of 25° to 85° Fahrenheit during application and cure, unless a special formulation is being used and Manufacturer has been consulted.

B. Relative humidity in the specific location of the application shall be less than 85 percent and the surface temperature shall be at least 5 degs. above the dew point.

C. Conditions required of new concrete to be coated with MMA materials:
   1. Concrete shall be moisture cured for a minimum of 7 days at 70° F. The concrete must be fully cured for a minimum of 28 days prior to application of the coating system pending moisture testing.
   2. Surface contaminants such as curing agents, membranes, or other bond breakers should not be used.
   3. Concrete shall have a "rubbed" finish; float or darby finish the concrete (a hard steel trowel is neither necessary nor desirable).
   4. Drains should be set to the concrete grade rather than raised to the finished grade of the topping.

D. Concrete shall have a moisture emission rate of no more than 3 lbs. per 1000 sq. ft. per 24-hour period as determined by proper Calcium Chloride Testing or less than 90% RH (relative humidity) when testing with in-Situ Probe testing.

E. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

F. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. The self-leveling Full Flake floor topping system shall be 1/8" thick (color and texture selected by owner), with appropriate Primer and Topcoat.

B. The self-leveling Full Flake topping system shall cure and be available to normal traffic in no more than 60 minutes at 68° F. after application of last coat. The cured material shall have a minimum compressive strength of 6,000 psi in accordance with ASTM C109. It shall have a maximum water absorption value of 0.04 weight percent in accordance with ASTM D570. It shall be chemically resistant to a wide range of acids, alkalis, salts, fats, oils, and other chemicals typically found in K-12 school environments.

C. The finished floor coating system shall be uniform in color, texture, and appearance. All edges that terminate at walls, floor discontinuities, and other embedded items shall be sharp, uniform, and cosmetically acceptable with no thick or ragged edge. The Contractor/Applicator shall work out an acceptable masking technique to ensure the acceptable finish of all edges.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Key MMA Chip 900, Key Resins Company (Basis of Design)
   2. BASF Flooring
   3. SILIKAL
   4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.3 MATERIALS

A. Methyl Methacrylate (MMA) Acrylic Resin System:
1. Saturating Primer/Sealer Coat: Key MMA 9112
2. Coving (if required): Key MMA Cove Paste with appropriate filler
3. Patching/Sloping (if required): Key MMA Polymer Concrete 9510 MMA Resin
4. Key 9418 Self-Leveling, consisting of MMA resin and decorative vinyl chip broadcast.
5. Topcoat(s) of clear, UV resistant 9526 MMA finish
6. Pigment of 9418: Color to compliment Colored Vinyl Flake.
7. Key Broadcast Vinyl Flake/Chips:
8. If added skid resistance is required, aluminum oxide or NSA (polycarbonate non-skid additive beads), may be broadcast into the primer or body coat or suspended into finish coat to to achieve specified skid/slip resistance requirements. Mesh size and rate to be determined by Owner based upon recommended amounts described by Mfg. for various COF.

B. Colors: As selected by Architect from manufacturer's full range and/or to match existing color and texture for the desired flooring affect.

2.4 PRODUCT PERFORMANCE CRITERIA

A. Key 9112 Primer/Sealer

1.	Percentage Reactive Resin:	100%
	Percentage Solids	100%
2.	Physical Properties	
a.	Working Life, 50ºF-70ºF	8-10 minutes, will vary with temp. & amount of Hardener
b.	Recoat Time	45-60 minutes
c.	Viscosity	250-270 cps
d.	Weight per Gallon	8.3 lbs.
e.	Bond Strength:	300-400+psi (100% concrete failure)

B. Key Polymer Concrete 9510 MMA Resin

1.	Appearance	Bluish tint, low viscosity
2.	Viscosity @ 75ºF:	140-150 cps
3.	Weight per Gallon:	8.1 lbs.
4.	Percent Reactive:	100%, zero VOC
5.	Pot Life (working time) 73ºF:	20-25 minutes
6.	Tensile Strength (filled mortar):	7,800
7.	Bond Strength	300-400+ psi (100% concrete failure)

C. Key 9418 MMA Binder

1.	Percentage of reactive resin:	100%
	Percentage of solids:	100%
2.	Appearance:	Viscous Liquid
3.	Viscosity, cps @ 73ºF:	280-290 cps
4.	Weight per Gallon:	8.1 lbs.
5.	Working Life, 50ºF-70ºF:	15-30 mins., will vary w/temp. @ amt. of Hardener
6.	Cure Rate:	40-60 minutes
7.	Recoat Time:	60 minutes

D. Key 9526 MMA Sealer/Topcoat Resin

1.	Percentage Reactive Resin:	100%
2.	Percentage Solids:	100%
3.	Working Life, 50ºF-70ºF:	10-25 minutes, will vary w/temp. @ amt. of hardener
4.	Recoat Time:	60-120 minutes

5.	Viscosity @ 75ºF:	380-390 cps
6.	Weight per Gallon:	8.3 lbs.
7.	Heat Resistance, dry heat:	216ºF
8.	Shore D Hardness:	65-70

2.5 PRODUCT INSTALLATION & APPLICATION CRITERIA

A. All Key MMA Material Systems:

1.	Pot Life at 68° F.:	10-15 minutes
2.	Cure Time at 68° F.:	60 minutes
3.	Recoat Time at 68° F.:	60-90 minutes

2.6 MIXES

A. Follow Manufacturer's prescribed procedures and recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all surfaces to be coated with Key MMA material systems and report to the Owner and/or Architect any conditions that will adversely affect the appearance or performance of these coating systems and that cannot be put into acceptable condition by the preparatory work specified in Paragraph 3.03.

B. Do not proceed with application until the surface is acceptable or authorization to proceed is given by the Owner’s Representative.

C. In the event that Applicator has employed all acceptable methods of surface preparation and cannot remedy adverse conditions that would lead to failure of the installation, Applicator shall withdraw from the contract and Owner will be financially responsible only for preparation efforts.

3.2 GENERAL

A. Material storage area must be selected and approved by Applicator and Owner or his representative.

B. If existing ventilation is inadequate, Applicator will provide sufficient ventilation to allow complete air exchange every five (5) minutes.

C. Applicator will protect adjacent surfaces not to be coated with masking and/or covers. Owner's equipment, materials, and existing finishes shall be protected from dust, cleaning solutions, and flooring materials.

3.3 PREPARATION

A. Surface Preparation – General

1. Concrete substrate must be clean and dry. Dislodge dirt, mortar spatter, paint overspray, and other dry surface accumulations and contamination by scraping, brushing, sweeping, vacuuming, and/or compressed air blowdown.
2. New concrete: See 1.7.C for requirements.
3. Surfaces that are heavily contaminated shall be cleaned with the appropriate degreaser, detergent, or other appropriate cleaner/surfactant followed by thoroughly rinsing with fresh water to remove the accumulation prior to mechanical cleaning efforts. Mechanical cleaning will not remove such deposits, but only drive them deeper into the substrate.
4. Concrete shall have a moisture emission rate of no more than 5 lbs. per 1000 sq. ft. per 24-hour period as determined by proper Calcium Chloride Testing or 90 RH via in-Situ Probe tests
5. Existing Painted Surfaces: “Float” walls using product acceptable to Manufacturer to achieve a smooth flat surface acceptable to receive Key MMA material systems.

B. Bond Testing
1. The Applicator shall evaluate all surface preparation by conducting bond tests at strategic locations.
2. Mix six (6) ounces of the primer to be used in the application with #10-#12 mesh, dry quartz sand until an easily trowelable mixture is obtained. Add 10% by volume Key 9000 MMA Hardener (BPO Powder) and mix well. Apply palm-sized patties 1/8" to 1/4" thick.
3. After one (1) hour at 68° F, patties must be cured tack-free in ambient temperature of concrete.
4. Remove patties with hammer and chisel and examine fracture/delamination plane. Concrete with fractured aggregate must be attached when this has been completed.
5. If only laitance or a small amount of concrete is attached or if interface between patty and substrate is tacky, further substrate preparation is required.
6. If further surface preparation is required, bond tests shall be conducted again when this has been completed.
7. If no amount or kind of surface preparation produces satisfactory bond tests, the applicator shall report that to the Owner, Architect, and Manufacturer.

C. Mechanical Surface Preparation and Cleaning
1. All accessible concrete floor surfaces shall be mechanically blast cleaned using a mobile steelshot, dust recycling machine such as BLASTRAC, as manufactured by Wheelabrator Corp., or approved equivalent. All surface and embedded accumulations of paint, toppings, hardened concrete layers, laitance, power trowel finishes, and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a profile similar to 40 grit sandpaper and exposing the upper fascia of concrete aggregate.
2. Floor areas inaccessible to the mobile blast cleaning machines shall be mechanically abraded to the same degree of cleanliness, soundness, and profile using vertical disc scarifiers, starwheel scarifiers, needle guns, scabblers, or other suitably effective equipment.
3. After blasting, traces or accumulations of spent abrasive, laitance, removed toppings, and other debris shall be removed with brush or vacuum.
4. Conduct Bond Tests to check adequacy of surface preparation. See Paragraph 3.3.B (Bond Testing).
5. Application of the respective specified material system(s) must be completed before any water or other contamination of the surface occurs.

3.4 INSTALLATION

A. Application of Key 9418 MMA Binder. Colored Flake Flooring System consists of:
1. Applying the primer/sealer
2. Applying coving (if required)
3. Performing patching and sloping with Key MMA Polymer Concrete (if required)

4. Re-priming with 9122 over MMA Polymer Concrete areas
5. Applying the topping, broadcasting the Colored Flake
6. Applying the topcoat: Time for curing (45 - 60 minutes) shall be allowed between each coat. Thicknesses are specified below and/or in Paragraph 3.8.

B. Open only the containers of component materials to be use in each specific application as needed. Refer to Manufacturer's data sheets for pot-life/temperature relationship to determine size of batches to mix and mix ratios for each respective coat of the system.

C. Measure, add, and mix the initiator Key 9000 MMA Hardener (BPO Powder Hardener) into the respective resin components in the proportions recommended by the Material Manufacturer. Pot life is short, so mix only as much material at a time as can be easily and efficiently applied.

3.5 PRIME COAT

A. Measure, add, and mix the initiator component, and initiator (SRS Powder Hardener) into the respective resin components in the proportions recommended by the Material Manufacturer.

B. Pour the mixture batches onto the floor surface and use a 9" or 18" wide, 1/2" - 3/4" thick-napped, solvent-resistant paint roller to roll out the material at a rate of 100 sq. ft./ gal. to form a uniform, continuous film, ensuring that all crevices, cracks, other surface discontinuities have been saturated and coated. Use a paint brush to reach areas inaccessible to the roller. Work quickly and deliberately; the pot life is short (10 -15 minutes). Do not leave any "puddles"; roll out any such accumulations.

C. Allow the primer/sealer coat to cure.

D. If any of the concrete has absorbed all of the primer or if the concrete still has a dry look, reprime these areas before applying Wearcoat or Topcoat.

3.6 COVING

A. Surface Preparation
1. If concrete walls are to be painted prior to installation of cove base, the bottom portion of the walls shall remain un-coated to the height of the cove base to insure a proper bond to the concrete wall.
2. If walls are constructed of a non-compatible material or if a coating exists, a backer board of ¼” plexiglass or ½” cement board cut to the desired height of the cove base needs to be installed. The top of the backer board should be cut at a 45° angle to create a “beveled” edge.
3. If a backer board needs to be installed it shall be fastened using a high-grade construction adhesive as well as counter sunk screws or concrete masonry anchors.

B. System Description
1. Cove base shall be installed according to manufacturers recommendations and shall be one of two systems:
   a. CB Filler Cove Base consisting of “spooned in” radius and brush on body coat.
   b. Trowel-On Cove Base consisting of a trowel applied radius/base mix with a termination strip installed at the top of the base.

C. Cove base will receive a broadcast and top coat consistent with flooring system.

3.7 PATCHING/SLOPING

A. Measure, add, and mix the R17 Resin, Powder Component, and necessary aggregate (if required) in the proportions recommended by the Material Manufacturer.

B. Use mixture to repair any damaged concrete, or to slope any areas as needed. Apply to masonry wall surfaces so that existing mortar joints do not telegraph to final top coat finishes.

C. Once cured, material must be re-primed before topping system is applied.

3.8 TOPPING

A. Size the batches and mix according to Manufacturer's instructions. The entire batch should be poured and spread at once, i.e., do not let material set in pail.

B. Spread the topping material with a gauge rake set to a depth of 1/8”. Lightly trowel to a uniform thickness of 1/8” as necessary.

C. Immediately after application, roll with a porcupine roller available from the Manufacturer to release any trapped air from the topping.

D. Broadcast Colored Flake into the fresh material before it begins to cure. It is important that the flake "rains" down, and not be thrown into, the surface.

E. Allow the topping to cure.

F. Remove excess flakes by sweeping, “blow-down”, and/or vacuuming. Lightly abrade surface to remove loosely bonded Colored Flake with a medium-stiff brush on a swing style floor machine or abrade using med-coarse fiber pad, or stiff bristle push-broom. Vacuum prior to next step.

3.9 TOP COAT

A. Apply with clean rollers at a rate of 100 - 125 sq. ft./gal. in the same way as the Primer/Sealer was applied as described in Paragraph 3.5.B.

B. (If Required) Broadcast aluminum oxide, glass beads, or other suitable material into wet topcoat resin; size and rate as determined by owner.

C. Allow topcoat to cure. Floors without aluminum oxide or glass bead broadcast may be lightly sanded if required. Vacuum all dust, paying particular attention to edges and corners.

3.10 SECOND TOPCOAT

A. Apply with clean rollers at a rate of 100 - 125 sq. ft./gal. in the same way as the Primer/Sealer was applied as described in Paragraph 3.5.B.

B. Allow topcoat to cure.

3.11 FIELD QUALITY CONTROL/INSPECTION

A. Applicator shall request acceptance of surface preparation from the Engineer before application of the prime/seal coat.

B. Applicator shall request acceptance of the prime/seal coat from the Engineer before application of subsequent specified materials.

C. All work not acceptable to the Architect, Engineer, or Owner must be corrected before consideration of final acceptance.

3.12 CLEANING

A. Applicator shall remove any material spatters and other material that is not where it should be. Remove masking and covers taking care not to contaminate surrounding area.

B. Applicator shall repair any damage that should arise from either the application or clean-up effort.

3.13 COATING SCHEDULE

A. Primer shall be R41i. Application rate shall be approx. 100 sq.ft. per gallon (approx. 12 mils).

B. Coving shall be R61 with appropriate filler installed per manufacturers recommendations.

C. Patching/Sloping material shall be R17

D. Body coat shall be R61SL applied with a gauge rake set at 1/8" for a rate of 40 sq. ft. per batch. Colored Flake to be broadcast into the uncured topping. Broadcast the Colored Flake at the rate of 0.10 – 0.15 pounds per sq. ft.

E. Clear topcoat shall be R71; apply at the rate of 100 - 125 sq. ft. per gallon for the first coat and 100 - 125 sq. ft. per gallon for the second application.

3.14 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 68 13 – ENTRY MAT CARPET TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes modular, tufted entry mat carpet tile.

B. Related Sections include the following:
   1. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base and accessories installed with carpet tile.
   2. Division 9 Section "Carpet" for carpet installed in areas other than entries.

1.3 DESCRIPTION

A. The project consists of floor surface preparation and the installation of new entry mat carpet tile, and other related work as required for a complete and finished product.

B. The work shall include the furnishing of all labor, tools, equipment, material, supervision, coordination, transportation, and the performance of all operations and related items required to provide the above-mentioned work and shall include the cleanup and removal from the site of all debris resulting from the operations performed. It shall also be the Contractor's responsibility to take all necessary safety precautions and to furnish barricades and/or any safety measures as may be required to complete the recarpeting as shown on the Drawings, and further described in the Specifications and Contract Documents.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.
   1.
   2. Testing: Verification elevator cab flooring meets ASTM E648-08 - Standard Test Method for Critical Radiant Flux Floor Covering Systems.
   3.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Entry Mat Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.

C. Product Schedule: For entry mat carpet tile. Use same designations indicated on Drawings.

D. Qualification Data: For Installer.

E. Maintenance Data: For entry mat carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining entry mat carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to entry mat carpet tile.

F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.7 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install entry mat carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

A. Special Warranty for Entry Mat Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Warranty Period: Start at date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Entry Mat Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 ENTRY MAT CARPET TILE – F5

A. Products: Provide the following:
1. Takrkett Tandus Centiva ;
a. Style: Abrasive Action II 02578
b. Color: Charcoal 19100
c. Molded Reinforced Needlepunch Textile.
d. Surface Texture: Rubber Reinforced Geometric Pattern
e. Finished Pile Thickness: .250”
f. Fiber System: 100% Premium Polypropylene
g. Dye System: Solution dyed
h. Backing Materials: Special Non-Thermoplastic Tri-Grip Cleated SBR
i. Total Weight: 135 oz/yd5
j. Size: 18” x 18”
k. Elevator cab flooring shall meet ASTM E648-08 - Standard Test Method for Critical Radiant Flux Floor Covering Systems.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by entry mat carpet tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting entry mat carpet tile performance. Examine entry mat carpet tile for type, color, pattern, and potential defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with entry mat carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive entry mat carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

D. Moisture Testing: Perform one or both of the tests indicated as recommended by manufacturer. Proceed with installation only after substrates meets manufactures requirements.
   a. Perform anhydrous calcium chloride test, ASTM F1869.
   b. Perform relative humidity test using in situ probes, ASTM F2170.
   c. If moisture testing cannot be performed or produces results not conforming to manufactures requirements, provide a Topical Moisture Vapor Mitigation System.

E. Broom and vacuum clean substrates to be covered immediately before installing entry mat carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with entry carpet tile manufacturer's written installation instructions.

B. Maintain dye lot integrity. Do not mix dye lots in same area.

C. Cut and fit entry mat carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by entry mat carpet tile manufacturer.

D. Extend entry mat carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

F. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing entry mat carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by entry mat carpet tile manufacturer.
   2. Remove yarns that protrude from entry mat carpet tile surface.
   3. Vacuum entry mat carpet tile using commercial machine with face-beater element.

B. Protect installed entry mat carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect entry mat carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by entry mat carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 68 16 - VINYL BACKED CUSHIONED CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sheet carpet.
2. Carpet accessories.

B. Related Sections:

1. Division 9, Section “Resilient Base and Accessories” for resilient base, reducer strips, and other accessories installed with carpet.

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.3 DESCRIPTION

A. The project consists of floor surface preparation and the installation of new carpeting, entry mat carpet tile, and other related work as required for a complete and finished product.

B. The work shall include the furnishing of all labor, tools, equipment, material, supervision, coordination, transportation, and the performance of all operations and related items required to provide the above-mentioned work and shall include the cleanup and removal from the site of all debris resulting from the operations performed. It shall also be the Contractor's responsibility to take all necessary safety precautions and to furnish barricades and/or any safety measures as may be required to complete the recarpeting as shown on the Drawings, and further described in the Specifications and Contract Documents.

1.4 QUALITY CONTROL

A. All carpet shall be from the same dye lot. On-site storage of carpet for future phases will not be available. The Contractor shall provide carpet storage per manufacturer’s recommendations between Phases.

B. The Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this specification.

C. If in the opinion of the Owner, insufficient numbers of workmen are being utilized to finish the project within the specified time, the owner may request more workmen.

D. Where a particular manufacturer and its model number or name is mentioned in connection with any item, they are listed to illustrate the **only** products that are acceptable to the District. **No substitutions will be evaluated or accepted.**

E. The owner will award the bid with the understanding that the bids received were based upon the specified materials.

F. Installation must be performed by a firm with not less than five (5) years of experience in installation of commercial carpet, by methods similar to those required for this project.

G. Installation must be performed by an installer that is approved by the manufacturer to coordinate with warranties offered by the manufacture.

H. Manufacturer is required to notify Owner, Architect, and General Contractor if installation instructions are not completely followed.

I. Manufacturer must have been in continual operation for a minimum of ten years.

J. Manufacturer will be on site to review startup of carpet installations to verify proposed installation procedures are correct and proposed seaming procedures are done in a proper fashion to stand by any warranties especially in the case of seams and carpet adhesion to substrate. **Written verification of review and acceptance of these startup installation procedures will be required by the Owner**. In addition, Manufacturer will be on site to review all installations within a three (3) month period **after** installation is complete to verify installation is correct and seaming was done in a proper fashion to stand by any warranties especially in the case of seams and carpet adhesion to substrate. **Written verification of review and acceptance of the completed installation will be required by the Owner.**

1.5 SUBMITTALS

A. Contractor shall submit samples of each color pattern of carpet available for the Owner's review for selections. Colors and patterns submitted for selection shall be available to meet the project schedule. Contractor shall also submit the manufacturer's specifications covering the manufacture of the carpeting which they are proposing. The specifications shall include all minimum material specifications as listed in Section 2.1 (B).

B. Contractor shall submit within fifteen (15) calendar days after the receipt of the Owner's Notice to Proceed, but before work begins. Manufacturer's recommended installation procedures which, when approved by the Owner, will become the basis for accepting or rejecting actual installation procedures used on the work.

C. A Seaming Diagram **will be required.** Field seaming shall be discussed with and agreed to by the District representative prior to installation.

1. Classroom Seaming Layout: The seams in the classrooms shall run perpendicular to the corridor wall.

D. Maintenance Manual: After award of bid, the Contractor shall furnish the Owner at least three (3) printed copies of the manufacturer's recommendation for the care, cleaning and maintenance of the carpet furnished and thoroughly instruct the Owner's maintenance personnel in the care, cleaning, and maintenance of the carpet if requested. This instruction shall happen once.

1.6 TESTING

A. The Owner may decide that testing is required in order to establish conformance with these specifications. The Owner will select a prequalified independent testing laboratory should it be required. All testing will be in accordance with all pertinent codes and regulations and with selected standards of the American Society of Testing and Materials. All testing and retesting costs will be paid for by the Owner, except as otherwise directed in these specifications.

B. It shall be the Contractor's responsibility to, at all times, cooperate with the testing laboratory. Representatives of the testing laboratory shall have access to the work at all times and at all locations where the work is in progress. All specimens and samples for testing shall be taken by the testing personnel or Owner. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory or the Owner. The Contractor shall establish with the testing laboratory a schedule of time to perform tests. If changes occur in this schedule, the Contractor shall coordinate all such changes with the testing laboratory. If the testing laboratory is prevented from taking specimens or testing due to uncoordinated time changes or incompleteness of the work, all extra charges for testing attributable to the delay will be back charged to the Contractor and shall not be borne by the Owner.

1.7 PRODUCT HANDLING

A. Except as otherwise approved by the Owner, determine and comply with manufacturer's recommendations on product handling, storage, and protection. The Contractor shall provide all storage of materials used throughout this section.

B. Deliver products to the job sites in their manufacturer's original container, with labels intact and legible. Maintain packaged materials with seals unbroken and labels intact until time of use. Carpet rolls shall have register number and tag attached or register numbers stenciled on bale and intact until time of use.

C. The Owner may reject as noncomplying such material and products that do not bear identification satisfactory to the Owner as to manufacture, grade, quality, and other pertinent information as specified.

D. The Contractor shall promptly remove damaged material and/or unsuitable or rejected items from the job site, and promptly replace with materials meeting the specified requirements, at no additional cost to the Owner.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

PART 2 - PRODUCTS

2.1 VINYL BACKED CUSHIONED CARPET

A. The specifications for carpeting outlined below are for the purpose of establishing quality standards required under the contract. Only the manufacturer's and products listed will be acceptable. There will be no evaluations of other products prior to bid, nor will their be any substitutions reviewed or allowed. Failure to submit a bid utilizing one of the listed products will be cause for rejection of the bid.

B. Carpet – General
1. All materials shall be new and of domestic manufacture. Carpet of each type is to be of first quality and from one dye lot.
2. All carpet to have built-in permanent static control, anti-microbial treatment, soil and stain protection treatment, and a moisture barrier backing.

C. Material Specifications

1. Construction/Face Pattern:

a. Level Loop.
b. 8.5 stitches per square inch
c. 13th Gauge or higher
d. Primary Backing: Non-woven synthetic fiber
e. Width: 6 feet
f. Tuft Density: 108.8 tufts/sq in
g. Pile Height Average: 0.117 inch
h. Pile Thickness: 0.081 inch
i. Primary Tufting Substrate: Synthetic Non-Woven

2. Yarn System:

a. Antron Legacy Nylon
b. Face weight **no greater** than 22 oz. and **no less** than 18 oz.

3. Backing System:

a. Closed Cell Vinyl Cushion – ASTM D 1667; Min. 7 psi @ 25%; Max. 25 psi @ 25%
b. Permanently fused to tufting blanket
c. No Moisture Penetration in field or seams after 10,000 Impacts.
d. No backing degradation after 50,000 cycles from Phillips Chair Caster Test

4. Installation System:

a. Factory supplied non-wet, low VOC adhesive
b. No off-gassing required
c. **Permanent chemically welded seams**
d. No seam degradation after 50,000 cycles from Phillips Chair Caster Test

5. Sustainability: Manufacturer guarantees in writing that if materials are sent back for recycling, none will be landfilled or incinerated.

D. Approved Carpet: Furnish carpet of one of the following, subject to meeting material, performance and warranty requirements of this Section.

1. Tarkett Flooring: textured patterned loop pile carpet with “Powerbond RS” backing; 18 ounce yard face weight minimum. Furnish in 6-foot wide rolls with low VOC non-wet peel and stick adhesive installation.

a. Flooring Type F1:
    a. Style: Primary Colors Collection #11906
        i. Color: “Energy” #55306
b. Flooring Type F1A:
    a. Style: : Primary Colors Collection #11906
        i. Color: “Moonray” #55307

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Owner.

PART 3 - EXECUTION

3.1 SURFACE AND CONDITIONS

A. Examine all areas and conditions under which work will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until satisfactory conditions are corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

At contractor’s option, ridges at joints and slab edges may be ground using pwered grinding equipment.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 CARPET INSTALLATION

A. Align the lines of carpet, as woven, using no fill strips less than 12" wide. Lay all carpet in the same direction unless specifically directed otherwise by the Owner.

B. Locate seams only where specifically approved by the Owner. Locate seams to the maximum extent possible out of the way of traffic. Fabricate seams by the compression method, using a butt joint and properly chemically weld, bead and seal.

C. After installation: When installation is completed, clean up all dirt and debris, clean carpet of all spots. Remove all loose threads with scissors. Vacuum carpet.

D. Where any Tarkett Flooring is installed, specifically peel-and-stick 6' wide rolls of Color Spectrum carpet, the contractor shall be responsible for contacting:

Tarkett Flooring
Mike Milhous, LEED AP e-mail: mmilhous@tandus.com
3702 Sudor Lane, Loomis CA 95650
Cell: (916) 806-8502 Fax: (916) 765-2839

for a post-installation inspection by the carpet manufacturer.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

PART 4 - GUARANTEE

4.1 MANUFACTURER'S WRITTEN WARRANTY

A. All of the product related warranties listed below must be submitted as published warranties and presented as sample copies prior to approval. The originals must be signed by an official of the corporation that manufactures the carpeting and submitted to the Owner after installation is complete.

1. Specification Warranty: The manufacturer warrants that the carpet conforms to specifications established for the product identified in the execution section, subject to normal manufacturing tolerances.
2. Two Year Installation Workmanship: Provide special project warranty, signed by Contractor and installer, agreeing to repair or replace defective materials and workmanship of carpeting work during 2-year warranty period, without cost to Owner; and agreeing to repair or replace other defects beyond Contractor's/Installer's/Manufacturer's controls, as judged by Architect, at Owner's expense at prevailing rates.
3. 10 Year non-prorated Wear Warranty: This carpet is warranted by the manufacturer for indoor commercial use. This manufacturer guarantees that the surface fiber of this carpet will wear less that 10% by weight from abrasion over a period of 10 years from the date of installation. Any area showing greater wear under conditions of normal use will be replaced at the manufacturer's expense including labor charges, as long as the carpet was properly installed and maintained.
4. 10 Year non-prorated Adhesive Warranty: The Manufacture warrants that the carpet will remain attached to the substrate for a period of twenty (10) years from the date of installation.
5. 10 Year non-prorated Edge Ravel Warranty: The Manufacture warrants that the carpet will not have continuous ends coming out of lengthwise seams for a period of 10 years from the date of installation.
6. 10 Year non-prorated Zippering Warranty: The Manufacturer warrants that the carpet will not develop "pile yarn runners" in the body of the carpet for a period of twenty (10) years from the date of installation.
7. 10 Year non-prorated Delamination Warranty: The Manufacturer warrants that the carpet will not delaminate for a period of 20 years from the date of installation.
8. 10 Year non-prorated Texture Retention Warranty: The Manufacturer warrants that the carpet will substantially maintain its physical surface texture against crushing, matting and walking out for a period of twenty (10) years from the date of installation.
9. 10 Year non-prorated Run Resistance Strength Warranty: The Manufacturer warrants that the carpet will not zipper or develop continuous "pile yarn runners" for a period of twenty (20) years from the date of installation.
10. 10 Year non-prorated Colorfastness to Light Warranty: The Fiber Manufacturer warrants that when installed for indoor use only, the carpet will not display or significantly change color due to exposure to light for twenty (10) years from the date of installation. (Applies only to Antron Lumena)
11. Colorfastness to Atmospheric Contaminants Warranty: The Fiber Manufacturer warrants that when installed for indoor use only, the carpet will not display or significantly change color due to the atmospheric contaminants (Ozone or Oxides of Nitrogen) for five (5) years from the date of installation. (Applies only to Antron Lumena)

END OF SECTION 09 68 16

SECTION 09 72 60 – TACKABLE WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient cork/linoleum tackable wallcovering.

B. Related Sections:

1. Division 09 Section "Interior Painting" for priming wall surfaces.
2. Section 07 92 00 – “Joint Sealants” for caulking perimeter at walls.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.

C. Samples for Initial Selection: For each type of wall covering and trim indicated.

D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

E. Qualification Data: For qualified testing agency.

F. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics Classification: Provide materials that meet classification ratings below: ASTM E84 (Flame Spread and Smoke Developed) II/B.

B. Single Source Responsibility: Obtain tackable wallcovering system components from a single source.

C. Deliver materials in original factory packaging, labeled with manufacturer, brand name, size, color, and lot number.

D. Store materials in original, undamaged packaging inside a well-ventilated area protected from weather, moisture, soiling, and extreme temperatures. Maintain room temperature within the storage area at not less than 68° F (20° C) during the period materials are stored.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F1141.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period. Maintain ambient temperature within the building at not less than 68° F (20° C) for a minimum of seventy-two hours prior to beginning of installation.

B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.6 WARRANTY

A. Submit manufacturer's limited five-year written warranty against manufacturing defects.

PART 2 - PRODUCTS

2.1 WALL COVERINGS

A. General: Provide rolls of each type of wall covering from same print run or dye lot.

2.2 TACKABLE WALL COVERING W3

A. General: Uni-color resilient homogeneous tackable linoleum surface consisting of linseed oil, granulated cork, rosin binders, and dry pigments calendered onto natural burlap backing. Color shall extend through thickness of material.
   1. Width: 48-inch, Gauge: 1/4 inch. Approximately ± 95 lineal foot rolls. Flexible enough to bend around a 2-3/4-inch radius. Dimensionally stable due to burlap backing.

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Manufacturer: Koroseal Interior Products Group: Walltalkers "tac•wall".
      a. Color: To be selected by Architect from manuf. full range
      b. Product No. C250-86
   2. Manufacturer: Forbo Flooring Systems: "Bulletin Board".

a. Color: To be selected by Architect from manuf. full range

2.3 ACCESSORIES

A. Adhesive: Solvent-free, SBR type linoleum adhesive (L-910)

B. Color matched caulk.

C. Aluminum Trim:
1. JT12-00: Clear satin, anodized aluminum, 1/4 inch (6 millimeter) J trim
2. IST12-00 Clear satin, anodized aluminum, ¼ inch (6 millimeter) Inside corner
3. OST12-00 Clear satin, anodized aluminum, ¼ inch (6 millimeter) Outside corner
4. DIV12-00 Clear satin, anodized aluminum, ¼ inch (6 Millimeter) divider moldings

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Gypsum Board: Prime with acrylic primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. CMU: ‘Float’ walls using USG or Hamilton’s All-Purpose Mud to achieve a smooth flat surface. Prime with acrylic primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION

A. Comply with manufacturer’s printed installation instructions.

B. Cut sheets to size including a few inches of overage. Allow sheets to lay flat for at least twenty-four hours prior to the application. Mark roll direction and sequence on the backside of each sheet. Hang sheets in sequence as cut from the roll, do not reverse sheets.

C. Permanent HVAC system should be set to 68° F (20° C) for at least seventy-two hours prior to, during, and after the installation.

D. Back roll each sheet prior to the installation to release curl memory.

E. For seamed applications, using a seam and strip cutter remove the factory edge of one sheet. Using the same tool, overlap and trace cut the mating edge of the second sheet. Repeat this step for as many sheets as required for the job.

F. Use aluminum j trim on all sides or inside and outside corners where applicable.

G. Apply adhesive with a 1/16-inch square notch trowel to the area receiving the sheet (apply enough for one sheet at a time).

H. Work from top to bottom then side to side. Roll sheet firmly into adhesive for positive contact and to remove air bubbles.

I. Remove adhesive residue immediately after each panel is hung with a mild soap/water solution and a soft cloth/sponge

J. Clean wallcovering using a sponge with a neutral pH cleaning solution. Do not use abrasive cleaners. Rinse thoroughly with water and let dry before using.

K. It is important to remove adhesive while wet.

L. Sand or file corners and cut ends of aluminum trim to remove sharp corners and edges.

M. Caulk visible exposed ends of aluminum corner pieces, where occurs.

N. Caulk edge of perimeter trim to match wall (gypsum board and/or CMU).

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 60

SECTION 09 77 20 – FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.
   1. Aluminum trim.

B. Products Not Furnished or Installed under This Section:
   1. Gypsum substrate board.
   2. Resilient Base.

1.2 RELATED SECTIONS

A. Section 09 29 00 – Gypsum substrate board.

B. Section 09 22 16 - Metal Stud Framing

C. Section 09 91 23 – Interior Painting.

D. Section 09 65 13 - Resilient Base.

1.3 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)
   1. ASTM D 256 - Izod Impact Strengths (ft #/in)
   2. ASTM D 570 - Water Absorption (%)
   3. ASTM D 638 - Tensile Strengths (psi) & Tensile Modulus (psi)
   4. ASTM D 790 - Flexural Strengths (psi) & Flexural Modulus (psi)
   5. ASTM D 2583- Barcol Hardness
   6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
   7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
   1. Submit complete with specified applied finish.
   2. For selected patterns show complete pattern repeat.
   3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.5 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
   1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
      a. Wall Required Rating – Class A.

B. Sanitary Standards: System components and finishes to comply with:
   1. United States Department of Agriculture (USDA) requirements for food preparation facilities, incidental contact.
   2. Food and Drug Administration (FDA) 1999 Food Code 6-101.11.
   3. Canadian Food Inspection Agency (CFIA) requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70°) for 48 hours prior to installation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work.

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
   1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.8 WARRANTY

A. Furnish a one-year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Marlite; 202 Harger Street, Dover, OH 44622. 800-377-1221, FAX (330) 343-4668, Email: info@marlite.com , Web: www.marlite.com.

B. Basis-of Design Product: Subject to compliance with requirements, provide Marlite Standard FRP panels, or comparable product.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600

2.2 PANELS

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
2. Dimensions:
   a. Thickness – 0.090 “ (2.29mm) nominal
   b. Width - 4'-0” (1.22m) nominal
   c. Length – [10’-0” (3.0m)] nominal
3. Tolerance:
   a. Length and Width: +/-1/8 “ (3.175mm)
   b. Square - Not to exceed 1/8 “ for 8 foot (2.4m) panels or 5/32 “ (3.96mm) for 10 foot (2.4m) panels

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
1. Flexural Strength - 1.0 x 10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
2. Flexural Modulus - 3.1 x 10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
3. Tensile Strength - 7.0 x 10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
4. Tensile Modulus - 1.6 x 10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
5. Water Absorption - 0.72% per ASTM D 570.
6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256

C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.

D. Front Finish:
1. All areas except Mechanical Room B109:
   a. Color:
      1) Marlite Standard FRP.
         a) P199 Bright White
   b. Surface: Pebbled
   c. Fire Rating: Class A (I) Fire Rating.
   d. Size:
      1) Marlite FRP
         a) 48” x 96” [1.2m x 2.4m] x .090” (3mm) nom.

2. At Mechanical Room B109:

e. Color:
   1) Marlite Smooth Surface FRP.
      a) S 100 S/2/S White
f. Surface: Smooth
g. Fire Rating: Class A (I) Fire Rating.
h. Size:
   1) Marlite FRP
      a) 48” x 96” [1.2m x 2.4m] x .090” (3mm) nom.

2.3 MOLDINGS

A. Aluminum Trim: Heavy weight extruded aluminum 6063-T5 alloy prefinished at the factory.
   1. Color: Brite Anodized

2.4 ACCESSORIES

A. Fasteners: Non-staining nylon drive rivets.
   1. Match panel colors.
   2. Length to suit project conditions.

B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
   1. Titebond Advanced Polymer Panel Adhesive – VOC compliant, non-flammable, environmentally safe adhesive.

C. Sealant:
   1. Marlite Brand MS-251 White Silicone Sealant.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
   1. Verify that stud spacing does not exceed 24” (61cm) on-center.

B. Repair defects prior to installation.
   1. Level wall surfaces to panel manufacturer’s requirements. Remove protrusions and fill indentations.

3.2 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8” (3 mm) clearance for every 8 feet (2.4m) of panel.
   1. Cut and drill with carbide tipped saw blades or drill bits or cut with shears.
   2. Pre-drill fastener holes 1/8” (3mm) oversize with high-speed drill bit.

a. Space at 8” (200mm) maximum on center at perimeter, approximately 1” from panel edge.
b. Space at in field in rows 16’ (40.64cm) on center, with fasteners spaced at 12” (30.48 cm) maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
1. Install panels with manufacturer's recommended gap for panel field and corner joints.
a. Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.
b. Drive fasteners for a snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
1. All moldings must provide for a minimum 1/8 “ (3 mm) of panel expansion at joints and edges, to insure proper installation.
2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

E. All trim and molding joints and corners shall be free of burrs and sharp edges.

3.3 CLEANING

A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION 09 77 20

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Requirements:

1. Section 05 10 00 - “Structural Steel” for the painting of structural steel members.
2. Section 05 50 00 - “Metal Fabrications” for the painting of miscellaneous metal fabrications.
3. Section 08 11 13 - “Hollow Metal Doors And Frames “for the painting of hollow metal doors and frames.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel

B. Related Sections include the following:

1. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with Washoe County School District standard requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Glidden
2. Sherwin-Williams
3. PPG
4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range and/or to match Owner's custom color.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated - unless otherwise noted.

1. In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: clean thoroughly, scrape and sand with all visible rust removed from surface. A “Rust Converter” such as Jasco Prep and Prime shall be applied to all surfaces that have rust damage. All glossy paint, bare metal, and areas primed with “Rust Converter” to be primed with a Latex All-Purpose Bonder, Primer and Sealer – Zinseer 1-2-3 or equal.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

F. Patching of all surfaces to be done **after** substrate is spot primed and allowed 24 hours to dry. Patching should be flush with the existing surface and match the texture of the existing surface. The patched area needs to be spot primed after patching compound has had the proper cure/dry time according to manufacturer’s recommendations.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates: All exposed to view steel substrates including hollow metal door frames, columns, beams, gate frames, etc. that do not have a factory finish, or are not galvanized.

1. Semi-Gloss Acrylic DTM System:
   a. Rust Converter: Jasco Prep and Prime (or equal)
   b. Prime Coat: Glidden Professional; Gripper Interior/Exterior Primer/Sealer, GP-3210-1200
   c. Intermediate Coat: PPG Architectural/Glidden High Performance Coatings; Pitt-Tech Plus Int/Ext High Gloss DTM Industrial Enamel; 90-1310.
   d. Top Coat: PPG Architectural/Glidden High Performance Coatings; Pitt-Tech Plus Int/Ext High Gloss DTM Industrial Enamel; 90-1310.
   e. Galvanized-metal substrates should not be chromate passivated (commercially known as "bonderized") if primer is field applied. If galvanized metal is chromate passivated, consult manufacturers for appropriate surface preparation and primers.

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Steel.
   2. Gypsum board.

B. Related Sections include the following:

   1. Section 05 31 00 - “Steel Decking” for the painting of exposed steel decking.
   2. Section 05 50 00 - “Metal Fabrications” for the painting of miscellaneous metal fabrications.
   3. Section 05 20 00 - “Metal Joists” for surface preparation and the application of primer coats on exposed steel members.
   4. Section 08 11 13 - “Hollow Metal Doors and Frames “for the painting of hollow metal doors and frames.
   5. Section 09 91 13 - "Exterior Painting" for surface preparation and the application of paint finishes on exterior substrates.
   6. Section 03 34 50 – “Concrete Finishes” for the painting of concrete floors designated to receive epoxy paint.
   7. Section 07 92 00 – “Joint Sealants” for various surfaces to receive paint.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. MPI Standards:
   1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with Washoe County School District standard requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Glidden
2. Sherwin-Williams
3. PPG
4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 PAINT, GENERAL

A. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: To match Washoe County School District Standard Colors.
1. Contractor to allow for 15% of all gypsum wallboard surfaces to receive a deep tone accent color. Up to four different accent colors will be used.
a. Colors to be selected by architect.

C. **All products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 775-851-5675.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Architecturally exposed structural steel shall be protected from spills, splatter and drips during construction.

B. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

C. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Masonry (Clay and CMU): 12 percent.
   2. Gypsum Board: 12 percent.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
   1. In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 775-851-5675.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: Finishes on exposed steel members shall result in an Architecturally acceptable finish.
   1. Before applying finish coat:
      a. Remove rust and loose mill scale.
      b. Remove any drips, runs, sags, wrinkling or webbing from the primer coat.
      c. Remove drips, and splatter from work above.
      d. Clean using methods recommended in writing by paint manufacturer.
      e. Re-prime as necessary.

E. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

F. Galvanized Metal: Allow to weather a minimum of 6 months prior to coating. Clean per Society for Protective Coatings SSPC-SP1 using detergent and water or a degreasing cleaner, then prime as required. When weathering is not possible or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test area, priming as required. Allow coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.

G. Concrete Substrates: Concrete must be cured at least 28 days @ 75 degrees F. Remove all loose droppings and foreign material. Surface must be free of laitance, concrete dust, dirt, form releaser agents, moisture curing membranes, loose cement and hardeners. Fill bug holes, air pockets and other voids with manufacturer's recommended product. Follow manufacturer's surface preparation information.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
   1. Mechanical Work:
      a. Uninsulated metal piping.
      b. Uninsulated plastic piping.
      c. Pipe hangers and supports.
      d. Tanks that do not have factory-applied final finishes.
      e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
      f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
   2. Electrical Work:
      a. Switchgear.
      b. Panelboards.

c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Steel Substrates: All steel substrates exposed to view including hollow metal door frames, stair railings, structural steel columns, structural steel beams, joists, metal decking, electrical conduits, plumbing piping, mechanical ductwork, etc.
   1. Alkyd System: MPI INT 5.1E.
      a. Bottom Coat: Glidden Professional; Alkyd Semi-Gloss Paint; GP-1507
      b. Intermediate Coat: Interior alkyd matching topcoat.
      c. Topcoat: Glidden Professional; Alkyd Semi-Gloss Paint; GP-1507

B. Gypsum Board & Plywood Substrates:
   1. Latex System: MPI INT 9.2A.
      a. Prime Coat: Glidden Professional; PVA Drywall Interior Primer and Sealer, GPD-0000
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Glidden Professional; Diamond 450 Interior Premium Acrylic Satin; GP-7400

C. Concrete Substrates: All concrete slab substrates designated to receive epoxy paint.
   1. Epoxy System: MPI 82
      a. Bottom Coat: Sherwin Williams ArmorSeal 33 Epoxy Primer/Sealer
      b. Intermediate Coat: Sherwin Williams ArmorSeal 1000 HS Epoxy coating matching topcoat.
      c. Topcoat: Sherwin Williams ArmorSeal 1000 HS Epoxy coating.

END OF SECTION 09 91 23

SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Markerboards. – wall mounted.

B. Related Requirements:

1. Section 09 22 16 - “Non-Structural Metal Framing” for backing to support visual display surfaces.

1.3 DEFINITIONS

A. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

B. Samples for Verification: For each type of visual display surface indicated.

1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch- long sections of each trim profile.
3. Display Rail: 6-inch- long sections.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

B. Maintenance Data: For visual display surfaces to include in maintenance manuals.

C. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Surfaces lose original writing and erasing qualities.
   b. Surfaces exhibit crazing, cracking, or flaking.
2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, ½" thick core material, and porcelain-enamel face sheet with low-gloss finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ADP Lemco, Inc.
   b. Best-Rite Manufacturing: (Basis of Design).
   c. Claridge Products and Equipment, Inc.
   d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 MARKERBOARD AND ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from extruded aluminum; standard size and shape.
   1. Factory-Applied Trim: Manufacturer’s standard.

B. Chalktray: Manufacturer’s standard, continuous.

   1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

C. Map Rail: Provide the following accessories:

   1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
   2. End Stops: Located at each end of map rail.

2.3 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

   1. Surface is magnetic for added versatility.

B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.

   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

   1. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.6 VISUAL DISPLAY SURFACES – WALL MOUNTED

A. Visual Display Board: Factory assembled.

1. Markerboard: Porcelain-enamel markerboard assembly.
   a. Color: White.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting: Wall.
6. Mounting Height: As indicated on Drawings.
7. Factory-Applied Aluminum Trim: Manufacturer's standard with clear anodic finish.
8. Accessories:
   a. Chalktray: Solid type.
   b. Map rail with display rail end stops.

B. VisualDisplay Surface Schedule:

1. Bestrite 202AH 4' x 8' Marker Board Porcelain Steel (608513) with map rail & dura-safe end caps packed & shipped in singles.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display surfaces.

C. Examine doors for proper preparation for visual display surfaces.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, brackets, anchors, trim, and accessories necessary for complete installation.

3.3 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall and door surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

3.4 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Panel signs.
2. Photo-etched zinc signs.
3. Owner furnished; contractor installed exit map frames.
4. Room Evacuation Location Signage

B. Related Requirements:
1. Section 22 05 53 - "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
2. Section 23 05 53 - "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
3. Section 26 05 53 - "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Full-size Sample.
2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
3. Exposed Accessories: Full-size Sample of each accessory type.

E. Submit 2 full size sample zinc-etched signs, illustrating thickness, etching depth, letter size and Braille characters.

F. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 SYSTEM DESCRIPTION

A. Signage package shall consist of room number and room usage signage to meet the requirements of Americans with Disabilities Act, Section 504 of the Federal Rehabilitation Act, ICC/ANSI A117.1-2003, and U.S. Public Law 92-112 (1986).

B. Signage design and installation shall comply with Americans with Disabilities Act Accessibility Guidelines (ADAAG), latest edition.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Accessibility Standard: Comply with applicable provisions in ICC A117.1 for signs.

2.2 PANEL SIGNS

A. Panel Sign: Sign with message and characters having uniform faces, and precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: Mohawk Sign Systems, Inc.; Process Series 200A - Sand Carved Format D.
   a. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Engraved Plastic-Laminate Sign: Plastic-laminate face laminated to contrasting phenolic core to produce composite sheet.

   a. Composite-Sheet Thickness: 0.25 inch.
   b. Engraved Graphics: Characters engraved through plastic-laminate face sheet to expose contrasting phenolic core.

      1) Tactile characters shall be raised the required 1/32" inches from sign face. Glue-on letters or etched backgrounds are not acceptable.
      2) All text shall be accompanied by Grade 2 braille. Braille shall be separated 1/2" from the corresponding raised characters or symbols. Grade 2 braille translation to be provided by signage manufacturer.
      3) Perimeter borders shall be 3/8".
      4) All letters, numbers and/or symbols shall contrast with their background, either light characters on a dark background or dark characters on a light background. Characters and background shall have a non-glare finish.

   c. Plastic-Laminate Color and Pattern: As selected by Architect from manufacturer's full range.
   d. Core Color: As selected by Architect from manufacturer’s full range of contrasting colors.
   e. Plaque material shall be melamine plastic laminate. The melamine shall be non-static, fire-retardant and self-extinguishing. The plastic laminate will be impervious to most acids, alkalies, alcohol, solvents, abrasives, and boiling water.
   f. Size of letters and numbers shall be as follows:

      1) Room numbers shall be 3/4"h.
      2) Lettering for room ID signs shall be 3/4"h.

3) Symbol size shall be 4"h.
4) Standard Grade 2 braille shall be 5/8" h., located below copy.

g. Copy position: CC (centered/centered)

3. Lettering style shall be Helvetica Medium.

4. Frame: Entire perimeter.

a. Material: Aluminum.
b. Frame Depth: As indicated.
c. Profile: Square.
d. Corner Condition in Elevation: Rounded to radius indicated.
e. Finish and Color: Clear anodized.

5. Mounting: Surface mounted to wall with exposed anchors.

2.3 PANEL-SIGN MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Plastic-Laminate Sheet: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.

2.4 ZINC-ETCHED SIGNAGE

A. Zinc photo-etched metal signs manufactured as follows:
1. Metal alloy to contain 99% zinc.
2. Nominal material depth shall be a minimum of .120 with an etching depth of .040.
3. Color with a minimum 70% contrast as required by ADAAG section 4.30.5: between background and characters. Characters shall be white. Background shall be dark grey. Background and characters shall have matte finish.
4. Sign shall be coated with a graffiti resistant clear coat.
5. Lettering, Braille, and Symbols/Pictographs shall conform to ADAAG section 4.30.4 requiring 1/32 inch raised above background. All characters must be accompanied by Grade 2 Braille.
6. Sizes and quantities as shown on drawings and/or schedule.
7. All work done shall be machine fabricated in accordance with Architect approved shop drawings with straight lines, square corners, or smooth bends, free from perfections which may affect appearance or serviceability. Curved sections shall be formed smooth and even radii. Signs shall be of one-piece construction.
8. Provide predrilled holes for screw attached signs. All signs are screw-attached

B. Lettering style shall be Helvetica Medium.

C. Sizes of letters and numbers shall be as follows:

1. Room numbers shall be 3/4" high.
2. Lettering for room usage identification shall be ¾” inches high.
3. Lettering for rest room identification shall be ¾” inch high.
4. Standard Grade 2 braille shall be 5/8" h., located below copy.

D. Letters and numbers shall be centered on sign.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.

C. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For snap-in changeable inserts beneath removable face sheet, furnish one suction or other device to assist in removing face sheet. Furnish initial changeable insert. Subsequent changeable inserts are by Owner.
2. For frame to hold changeable sign panel, fabricate frame without burrs or constrictions that inhibit function. Furnish initial sign panel. Subsequent changeable sign panels are by Owner.

2.7 ROOM EVACUATION LOCATION SIGNAGE

A. Printed Rectangular Aluminum signs
1. 040” thickness.
2. Coated both sides with a white baked enamel finish.

3. Printed with UV-resistant ink.
   a. Black lettering on white background.
4. Punched holes at each corner.
5. Attach to western CMU wall with self-tapping masonry anchors. Anchors heads to be black, silver or grey in color.
   a. Mounting locations to be coordinated with WCSD Representative.

B. Signage text to be as indicated on construction drawings. Use manufacturer's standard sizes where possible. Room number-only signage shall include the following numbers:

A-1	B-1	C-1	M1	S100
A-2	B-2	C-2	M2	S102
A-3	B-3	C-3	M3	
A-4	B-4	C-4	M4	
A-5	B-5	C-5	M5	
A-6	B-6	C-6	M6	
	B-7			
	B-8			
	B-9			
	B-10			

C. Seventy (70) Contractor-furnished, contractor installed (CFCI) exit map frames shall be attached to interior walls. Locations to be coordinated with the Owner's personnel.

   a. Basis of Design: Seco #SN8511Black 8.5"x11" snap frame,
      1) Black brushed aluminum frame.
      2) Quick snap hinged front load frame.
      3) UV-resistant anti-glare PVC front sheet.
   b. Architect will provide exit maps in electronic format to contractor. Contractor shall
   c. Contractor shall print exit maps in color on 80 lb. white paper.

2.8 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Methods:

1. Concealed Studs or Fasteners (Frame to substrate): Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
2. Two-Face Tape (Sign to frame): Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position and push to engage tape adhesive.
3. Zinc signage installation shall include the use of two (2) vandal-proof anchors, minimum, per sign, 3 inches or less in height and 4 anchors for larger signs.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 SIGNAGE SCHEDULE

A. As indicated on Drawings.

END OF SECTION 10 14 00

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Cast dimensional characters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.

   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

   1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

   1. Exposed Accessories: Full-size Sample of each accessory type.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 DIMENSIONAL LETTER SIGNS, GENERAL

A. Regional Materials: Dimensional letter signs shall be manufactured within 500 miles of Project site.

2.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 DIMENSIONAL CHARACTERS

A. Cast Characters. Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.

1. Basis-of-Design Product: Subject to compliance with requirements, provide 'Gemini Incorporated' or comparable product by one of the following:

a. A.R.K. Ramos.
b. ASI Sign Systems, Inc.
c. Metallic Arts.
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Character Material: Cast aluminum.
3. Character Height: 24 inches.
4. Thickness: 2 inches.
5. Finishes:

a. Integral Metal Finish: Buffed or Painted at Architects discretion.

6. Mounting: Concealed studs with 1" spacers.
7. Typeface: Futura.

2.4 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 19

SECTION 10 28 00 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Childcare accessories.
3. Under Lavatory guards.
4. Custodial accessories.

B. Related Sections:

1. Section 09 22 16 - "Non-Structural Metal Framing" for blocking and strap required for mounting accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.6 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 SUBSTITUTIONS

A. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser [D]:

1. Basis-of-Design Product: TORK; B-56TR; Surface-mounted Twin Jumbo Toilet Tissue Roll Dispenser.
2. Description: Double-roll dispenser.
3. Mounting: Surface mounted.
4. Capacity: Designed for jumbo tissue rolls.
5. Material and Finish: Plastic, Smoke Finish.

B. Paper Towel (Roll) Dispenser [H]:

1. Basis-of-Design Product: TORK; 83TR.
2. Description: Lever-actuated mechanism permits controlled delivery of paper rolls in preset lengths per stroke.
3. Mounting: Surface mounted.
4. Minimum Capacity: 8-inch-wide, 800-foot-long roll.
5. Material and Finish: ABS plastic, gray.
6. Lockset: Tumbler type.

C. Liquid-Soap Dispenser [F]:

1. Basis-of-Design Product: Purell CS4.
2. Description: Designed for dispensing soap.
3. Mounting: Surface mounted.

D. Grab Bar [A]:

1. Basis-of-Design Product: Bobrick; B-5806.99x36.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: Straight, 36 inches long.

E. Grab Bar [B]:

1. Basis-of-Design Product: Bobrick; B-5806.99x42.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches.

5. Configuration and Length: Straight, 42 inches long.

F. Grab Bar [C]:

1. Basis-of-Design Product: Bobrick; B-5806.99x18.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: Straight, 18 inches long.

G. Seat-Cover Dispenser [G]:

1. Basis-of-Design Product: Bobrick; B-221.
2. Mounting: Surface mounted.
3. Minimum Capacity: 250 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.

H. Mirror Unit [K]:

1. Basis-of-Design Product: Bobrick; B165 1836.
2. Frame: Stainless-steel channel.

    a. Corners: Welded and ground smooth.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
    b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

2.4 UNDERLAVATORY GUARDS

A. Under Lavatory Guard [N]:

1. Basis-of-Design Product: Truebro; Lav Guard 2.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.5 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder [M]:

1. Basis-of-Design Product: Bobrick; B-239.
2. Length: 34 inches.
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No.4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
   a. Contractor furnished portable fire extinguishers.

B. Related Requirements:

1. Section 04 22 00 - “Concrete Unit Masonry” for rough openings for fire protection cabinets in CMU walls.
2. Section 07 92 00 – “Joint Sealants” for perimeter caulking around cabinets.
3. Section 09 22 16 - "Non-Structural Metal Framing" for framing required rough openings for mounting fire protection cabinets in metal stud walls.
4. Section 09 29 00 - “Gypsum Board” for finishing surfaces surrounding fire protection cabinets.
5. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semi recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection and AED cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection and AED cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection and AED cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 FIRE EXTINGUISHER CABINET- FEC-1

A. Cabinet Type: Suitable for fire extinguisher device.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Basis-of-Design Product: Subject to compliance with requirements, provide Larsen's Manufacturing Company; AL2409-6R Semi-Recessed cabinet.
   b. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Aluminum sheet.

D. Semi recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/2-inch backbend depth.

E. Cabinet Trim Material: Aluminum sheet.

1. Thickness: .040"

F. Door Material: ½" thick Aluminum sheet.

G. Door Style: Vertical Duo glazed panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide keyed steel cam lock.
3. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Materials:

1. Aluminum: ASTM B 221, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 for extruded shapes.

   a. Finish: Clear anodic.

2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire extinguisher cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:

1. Fire-Extinguisher Cabinets: 54 inches above finished floor to top of cabinet.

B. Fire Extinguisher Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semi recessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-extinguisher cabinets, square and plumb.
4. Caulk joint where frame meets wall (gypsum board &/or CMU) around entire cabinet perimeter.

C. Combination AED/Bleed Control Cabinet:
1. Handle shall be not more than 48 inches above finished floor to top of cabinet.
2. Caulk joint where frame meets wall (gypsum board &/or CMU) around entire cabinet perimeter

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:
   1. Section 10 44 13 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. JL Industries, Inc.; a division of the Activar Construction Products Group.
      b. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
      c. Larsens Manufacturing Company.
      d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.
   2. Valves: Manufacturer’s standard.
   3. Handles and Levers: Manufacturer’s standard.
   4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type: UL-rated 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 11 68 00 - PLAY FIELD STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes freestanding and composite structure playground equipment, basketball goals, tetherball goals, bike racks, skateboard racks, fun ball goal, and skate stops.

B. Section includes playground markings (including US Map) and athletic court markings.

C. Section includes the installation of Owner-supplied exterior trash cans and benches.

1.3 DEFINITIONS

A. Fall Height: According to ASTM F1487, "the vertical distance between a designated play surface and the protective surfacing beneath it."

B. HDPE: High-density polyethylene.

C. IPEMA: International Play Equipment Manufacturers Association.

D. LLDPE: Linear low-density polyethylene.

E. MDPE: Medium-density polyethylene.

F. Use Zone: According to ASTM F1487, the "area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface, it is predicted that a user would land when falling from or exiting the equipment."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For playground equipment and structures. Include plans, elevations, sections, details, and attachments to other work.

1. **Contractor shall submit shop drawings showing play structure located inside the curbed play area. Drawings shall indicate clearances from curbed edges and fall zones.**

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Extent of surface systems and use zones for equipment.
2. Critical heights for playground surfaces and fall heights for equipment.

B. Qualification Data: For qualified manufacturer.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

B. United States Map Stencil: Submit stencil or template used to paint map.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.

1. Provide playground equipment and play structure components bearing the IPEMA Certification Seal.
2. Manufacturer shall be ISO 9001/2008 certified.

B. Installer Qualifications: An employer of workers approved by manufacturer.

C. Safety Standards: Provide playground equipment complying with or exceeding requirements in ASTM F 1487.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period:
a. Lifetime limited warranty on support posts (uprights)
b. 15-year limited warranty on punched steel decks, pipes, rails, loops, and rungs
c. 15-year limited warranty on rotomolded polyethylene components
d. Lifetime limited warranty on powerlock and hardware

PART 2 - PRODUCTS

2.1 PLAY FIELD STRUCTURES – KINDERGARTEN PLAY STRUCTURE

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide BCI Burke Company LLC or comparable product by one of the following:

      a. Landscape Structures Inc.
      b. Play & Park Structures
      c. GameTime
      d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Provide complete modular play structures, designed to be expandable and to form integral units for more than one play activity.

C. Provide play components as indicated on drawings, including decks, transfer systems, climbers, bridges, panels, roofs, slides, overhead events, and site-attached sensory or activity components.

   1 System General

      a. Basis of design shall be a Burke modular post-and-deck system such as Synergy(R), Nucleus(R), or approved equal.
      b. System shall be factory engineered to minimize field drilling and measuring.
      c. Platforms and components shall connect to support posts using factory-installed threaded inserts and Burke EZKonnect(R) or KoreKonnect(R) style multi-point engineered connections. Single-bolt or non-engineered attachment methods are not acceptable.
      d. Posts shall be factory marked for surfacing elevation where required and shall receive factory-installed caps, swaged tops, or equivalent water-shedding closure.
      e. Climbing access points, transfer systems, and guard/barrier transitions shall comply with age-appropriate ASTM F1487 requirements and the project accessibility layout.

   2. Materials and Components

      a. Fasteners: Tamper-resistant, inherently corrosion-resistant hardware included with equipment purchase. Button head cap screws shall be minimum 302HQ passivated stainless steel with locking adhesive patch. Other hardware shall be stainless steel or minimum Grade 5 zinc-plated steel. Moving component hardware shall be self-lubricating; ball bearings shall be maintenance-free sealed construction.
      b. Platforms: One-piece welded construction of CNC-fabricated 12-gauge HRPO steel with dipped PVC coating unless otherwise indicated. Platform surfaces shall have 3/8-inch CNC micro-punched holes prior to coating to prevent debris and water entrapment. Minimum area where used as basis of design: Nucleus triangle 997 sq in, square 2304 sq in, half hex 2993 sq in, split square 1152 sq in; Synergy triangle 561 sq in, square 1296 sq in, trapezoid 1440 sq in.
      c. Steel tubing: Galvanized cold-formed tubing with welded seam and uniform in-line Flo-Coat galvanizing, followed by chromate conversion coating and Burke premium two-part powder coat system. Interior of tubing shall receive zinc-rich corrosion-resistant coating. Tubing shall comply with ASTM A135 and ASTM A500 Grade B, minimum yield strength 50,000 psi and tensile strength 55,000 psi.

d. Aluminum tubing: Extruded alloy 6061-T6 seamless aluminum per ASTM B221. Minimum yield strength 35,000 psi and tensile strength 38,000 psi.
e. Rotationally molded polyethylene: Color-compounded LLDPE, double-wall construction, average 0.25-inch wall thickness on textured and non-sliding surfaces, UV-20 stabilized, UL94HB compliant.
f. HDPE panels: CNC-cut from solid UV-stabilized extruded HDPE with matte finish and rounded or chamfered edges. Thicknesses shall be 1/4 inch, 1/2 inch, or 3/4 inch as required.
g. Posts: Galvanized steel or aluminum posts finished with premium two-part powder coat system, laser-cut anchor slot or hole, and factory-installed 3/8-inch-16 threaded steel inserts with protective zinc finish. Steel post sizes shall include 5-inch OD x 11 ga or 7 ga and 3-1/2-inch OD x 11 ga. Aluminum posts shall be 3-1/2-inch or 5-inch OD with 1/8-inch wall thickness.
h. Roofs, slides, and molded activity components shall be rotationally molded LLDPE unless otherwise indicated. Transparent panels shall be extruded acrylic or polycarbonate of manufacturer's standard thicknesses as required for safety and clarity.
i. Rope climbing systems, if indicated, shall use 16 mm, 20 mm, or 22 mm steel-reinforced rope with polyester fiber covering, aluminum end connectors, and secure fixed-end connections.
j. Shade canopies, if indicated, shall use HDPE shade fabric with UV stabilizers and reinforced hems with galvanized cable attachment hardware.

3. Kindergarten Play Components

a. Provide a combination of age-appropriate climbers, transfer systems, sensory/activity panels, roofs, and slides as indicated on drawings.
b. Climbers may include molded pod climbers, welded steel rung climbers, low-rise step climbers, ridge-style climbers, and comparable Burke components configured for the kindergarten age group.
c. Panels may include bongos, hand cyclers, tactile panels, and other integrated sensory or manipulative play events.
d. Slides shall be single or double bedway molded polyethylene slides with smooth molded transitions, integrated drainage, and geometry compliant with ASTM F1487.
e. Transfer systems shall include accessible entry routes, handrails, and protective transitions where indicated.
f. Shade: Provide a combination of post-mounted and/or structure-integrated shade elements, comparable to BCI Burke Post Topper and ShadePlay canopy systems, or approved equal, sufficient to achieve a minimum of 50 percent shade coverage over the play area. Shade elements shall be integrated with the playground equipment and coordinated with play components, use zones, and required clearances.

2.2 PLAY FIELD STRUCTURES – K – 5th PLAY STRUCTURE

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Basis-of-Design Product: Subject to compliance with requirements, provide BCI Burke Company LLC model 907-204134-2_RepCopy or comparable product by one of the following:

a. Landscape Structures Inc.
b. Play & Park Structures
c. GameTime

d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Provide a complete playground system incorporating a variety of age-appropriate physical, social, sensory, imaginative, and developmental play opportunities.

C. Playground equipment shall include a combination of the following components as indicated on the Drawings:
1. Elevated and ground-level play events.
2. Climbing components of varying configurations and challenge levels.
3. Slides and other motion-based play events.
4. Upper-body and overhead play events.
5. Bridges, links, tunnels, or other connecting play components.
6. Sensory, tactile, musical, manipulative, or interactive activity panels.
7. Accessible transfer systems and/or accessible ground-level play components.
8. Platforms, decks, barriers, guardrails, handrails, and transition components.
9. Freestanding or structure-integrated play events where indicated.
10. Integrated playground shade elements, including post-mounted shade structures, structure-integrated shade canopies, roofs, or equivalent systems, comparable to BCI Burke Post Topper and ShadePlay canopy systems or approved equal, sufficient to provide a minimum of 50 percent shade coverage over the play area. Coordinate shade elements with play components, use zones, and required clearances.

D. Components shall be selected and configured for the intended age group and shall provide a range of challenge, movement, sensory engagement, and social play opportunities.

2.2.1 KINDERGARTEN PLAY COMPONENTS

A. Provide playground equipment complying with Paragraph 2.2 and specifically designed and configured for kindergarten-age users.
B. Provide a combination of developmentally appropriate climbing, sliding, sensory, manipulative, social, imaginative, and movement-based play components as indicated on the Drawings.
C. Provide accessible entry and play opportunities appropriate for the intended age group, including transfer access and ground-level accessible play events where indicated.
D. Equipment configuration, deck heights, access components, barriers, guardrails, slides, and climbing events shall comply with applicable ASTM F1487 requirements for the intended user age group.
E. Component selection shall emphasize a variety of play experiences rather than reliance on a single type of play event and shall be coordinated with the Drawings.

2.2.2 1ST - 3RD GRADE PLAY COMPONENTS

A. Provide playground equipment complying with Paragraph 2.1 and specifically designed and configured for 1st through 3rd grade users.
B. Provide a minimum of two slides or sliding events of differing configuration, height, or play experience, as indicated on the Drawings.
C. Provide a minimum of three climbing events offering varied climbing experiences and challenge levels. Climbing events may include pod, rung, step, wall, loop, rope, HDPE, or comparable climbing components.
D. Provide a minimum of two sensory, manipulative, musical, interactive, or activity panels/events, with at least one accessible from the ground level.
E. Provide a minimum of two elevated play events in addition to required access and slide events. Elevated events may include bridges, links, tunnels, overhead events, activity panels, or other structure-integrated play components.
F. Provide a minimum of two ground-level play activities, at least one of which shall be an accessible play event located on an accessible route.

G. Provide accessible play opportunities, including an accessible route to the play area, transfe access to elevated components where required, and accessible ground-level play events in accordance with applicable accessibility requirements.
H. Provide a variety of physical, social, sensory, imaginative, and upper-body play opportunities appropriate for the intended age group.
I. Provide integrated playground shade elements, including post-mounted shade structures, structure-integrated shade canopies, roofs, or equivalent systems, comparable to BCI Burke Post Topper and ShadePlay canopy systems or approved equal, arranged to provide a minimum of 50 percent shade coverage over the play area. Coordinate shade elements with play components, use zones, and required clearances.

2.2.3 4TH - 5TH GRADE PLAY COMPONENTS

A. Provide playground equipment complying with Paragraph 2.1 and specifically designed and configured for 4th through 5th grade users, with increased physical challenge and upper-body play appropriate for older elementary users.
B. Provide a minimum of two slides or sliding events of differing configuration, height, or play experience, as indicated on the Drawings.
C. Provide a minimum of four climbing events offering varied challenge, movement, and route options. Climbing events may include climbing walls, rope events, loop ladders, pod or step climbers, linked climbing circuits, or comparable components.
D. Provide a minimum of two sensory, manipulative, interactive, social, or activity panels/events, with at least one accessible from the ground level.
E. Provide a minimum of three elevated play events in addition to required access and slide events. Elevated events may include bridges, links, overhead ladders, upper-body events, climbing circuits, activity panels, or other structure-integrated play components.
F. Provide a minimum of two ground-level play activities, at least one of which shall be an accessible play event located on an accessible route.
G. Provide a minimum of two upper-body or overhead events designed to develop strength,coordination, and challenge appropriate for the intended age group.
H. Provide accessible play opportunities, including an accessible route to the play area, transfer access to elevated components where required, and accessible ground-level play events in accordance with applicable accessibility requirements.
I. Provide a variety of physical, social, sensory, imaginative, climbing, balance, and upper-body play opportunities, with multiple challenge levels and routes through the play environment.
J. Provide integrated playground shade elements, including post-mounted shade structures, structure-integrated shade canopies, roofs, or equivalent systems, comparable to BCI Burke Post Topper and ShadePlay canopy systems or approved equal, arranged to provide a minimum of 50 percent shade coverage over the play area. Coordinate shade elements with play components, use zones, and required clearances.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
2. Cast Aluminum: ASTM B 179.
3. Flat Sheet: ASTM B 209.

B. Steel: Comply with the following:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M, hot dip galvanized.
2. Steel Pipe: ASTM A 53/A 53M or ASTM A 135/A 135M standard-weight, hot-dip galvanized.

3. Steel Tubing: ASTM A 513, cold formed, hot dip galvanized.
4. Steel Sheet: ASTM A 1011/A 1011M, hot dip galvanized not less than G60 coating designation.
5. Perforated Metal: Steel sheet not less than 0.120-inch uncoated thickness; hot-dip galvanized; manufacturer's standard perforation pattern.
6. Expanded Metal: Manufacturer's standard carbon-steel sheets complying with ASTM F 1267, Type II (expanded and flattened); deburred after expansion.
7. Woven Wire Mesh: Manufacturer's standard, with wire complying with ASTM A 510.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666; Type 304; finished on exposed faces with No. 2B finish.

D. Opaque Plastic: Color impregnated, UV stabilized, and mold resistant.

1. Polyethylene: Fabricated from virgin plastic resin; rotationally molded HDPE, LLDPE, or MDPE with not less than 1/4-inch wall thickness.

E. Transparent Plastic: Abrasion-resistant, UV-stabilized monolithic polycarbonate sheet; clear, colorless; not less than 3/16 inch thick.

F. Chain and Fittings: ASTM A 467/A 467M, Class CS, 4/0 or 5/0, welded-straight-link coil chain; PVC coated. With commercial-quality, zinc-plated steel connectors and swing or ring hangers.

G. Castings and Hangers: Malleable iron, ASTM A 47/A 47M, Grade 32510, hot dip galvanized.

H. Post Caps: color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene; color to match posts.

I. Platform Clamps and Hangers: zinc-plated steel, not less than 0.105-inch-nominal thickness.

J. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a secure and vandal-resistant design.

K. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or plated steel and iron, or stainless steel; permanently capped, and theft resistant.

2.4 PLAYGROUND EQUIPMENT FABRICATION

A. General: Provide sizes, strengths, thicknesses, wall thickness, and weights of components as indicated but not less than required to comply with structural performance and other requirements in ASTM F 1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structure, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required to comply with referenced standards for equipment indicated.

1. Composite Play Structure: Provide complete play structure, designed to be modular, linked, and expandable, forming one integral unit for more than one play activity.

B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as indicated. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

C. Composite Frame: Fabricate main-frame upright support posts from metal and plastic with profile and dimensions as indicated. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

D. Protective Barriers: Fabricated such that openings within the barrier and between the barrier and the play surface preclude passage of the torso probe according to ASTM F 1487. Provide barriers designed to minimize the possibility of climbing, free of hand- and footholds, and configured to completely surround the protected area except for access openings. Extend barriers above the protected elevated surface for use by age group indicated. Fabricate from the following:

1. Welded metal pipe or tubing with vertical bars.
2. Steel sheet with openings for vision and ventilation.
3. Metal-pipe or -tubing frame with wire mesh infill panels.
4. Transparent plastic panels with openings.
5. Vertical wood balusters with metal pipe or tubing or wood frame.

E. Guardrails: Provide guardrails configured to completely surround the protected area except for access openings. Fabricate from welded metal pipe or tubing. Extend guardrails to comply with requirements for use by age group indicated.

F. Handrails: Welded metal pipe or tubing, OD between 0.095 to 1.55 inches.

1. Provide handrails at heights to comply with requirements for use by age group indicated according to ASTM F 1487.

G. Roofs and Canopies: Manufacturer's standard, designed to be positioned overhead and to discourage and minimize climbing by users.

1. Fabricated from opaque plastic.

H. Signs: Manufacturer's standard sign panels, fabricated from opaque plastic with graphics molded in, attached to upright support posts.

2.5 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: A minimum dry film thickness of 3 to 5 mils, medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

B. PVC Finish: Manufacturer's standard, UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added, complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness of 80 mils.

2.6 IRON AND STEEL FINISHES

A. Galvanizing: Hot-dip galvanized products made from rolled-, pressed-, and forged-steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M.

1. Hot-dip galvanized steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.

2. Galvanized-Steel Sheet: Commercial steel sheet, hot-dip galvanized, complying with ASTM A 653/A 653M for not less than G60 coating designation; mill phosphatized.

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

C. PVC Finish: Manufacturer's standard, UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added, complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness of 100 mils.

2.7 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, site surface and subgrade drainage, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading required for placing protective surfacing is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Verify locations of playground perimeter and pathways. Verify that playground layout and equipment locations comply with requirements for each type and component of equipment.

3.3 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed heights of equipment and components with finished elevations of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set with Concrete Footing: Comply with ACI 301M for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

2. Embedded Items: Use setting drawings and manufacturer's written instructions to ensure correct installation of anchorages for equipment.
3. Concrete Footings: Smooth top, and shape to shed water.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections: For playground and playground equipment and components at final completion and to certify compliance with ASTM F 1487.

C. Prepare test and inspection reports.

D. Notify Owner 48 hours in advance of date and time of final inspection.

END OF SECTION 11 68 00

SECTION 11 68 13 - FABRIC SHADE SHELTERS

PART 1 -GENERAL

1.1 SECTION INCLUDES

A. Fabric Shade Structures

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1. Section 03 30 00 - Cast-in-Place Concrete.
2. Section 05 50 00 - Metal Fabrications.
3. Section 06 10 00- Rough Carpentry.

1.3 SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.

B. Verification Samples: Two representative units of each type, size, pattern, and color.

C. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fabric shade strucutures to include in maintenance manuals.

B. QUALITY ASSURANCE

1. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience.

2. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.
3. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.5 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved Agenda shall include schedule, responsibilities, critical path items and approvals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

A. Manufacturer's standard limited warranty unless indicated otherwise.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fabric Shade Structures:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Basis-of-Design Product: Subject to compliance with requirements, provide shade structure by American Playground & Recreation Company, 46919 Cody Trail, Tea, SD 57064, Tel: 605-401-4250, Email: request info (customerservice@theamericanplayground.com);Web: https://theamericanplayground.com

1) Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2) Requests for substitutions will be considered in accordance with the provisions of Section 01 60 00.

2. Custom Sails Shade Canopies
   a. Designed to meet specific local codes.
   b. Freestanding Square Four Column Shade:
      1) Height: 12 ft.
      2) Size: 30 x 30 ft.
      3) Humidity Resistance, ASTM D2247-D2: 5,000 hrs. No blistering or adhesion loss.
      4) Color/UV Resistance, ASTM G154-04: 2,000 hrs exposure. No chalking.
      5) Roofing Panel Protection: Kynar 500 coating.
      6) Structural Steel Tubing: ASTM A500 Grade B. Plates: A36 steel. Welds: By AWS welders.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until the substrates have been properly constructed and prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

3.3 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

3.4 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturers recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 11 68 13

SECTION 12 36 61 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid-surfacing-material countertop w/integral sink
3. Solid surface material backsplashes.
4. Solid surface material end splashes.
5. Solid surface material apron fronts.
6. Solid surface material sinks.
7. Solid surface windowsills and wall caps.

B. Related Requirements:

1. Section 22 09 00 - "Plumbing Fixtures and Trim" for non-integral sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

1.3 INFORMATIONAL SUBMITTALS

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as indicated on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Formica Solid Surfacing, or comparable products by one of the following:

a. DuPont Corian
b. Wilsonart Solid Surface
c. Formica Traditions
   1) Color (countertops, sills, wall caps etc.): Formica #607 Ashen Concrete
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Integral Sink Bowls (Classrooms): Comply with CSA B45.5/IAPMO Z124.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart AV 1513, or comparable products by one of the following:

   1) DuPont Corian
   2) Formica Traditions
   3) Color:
      a) Integral Sinks: Designer White
   4) Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Countertops:

1. 1/2-inch- thick, solid surface material with front edge built up with same material.

C. Backsplashes: 1/2-inch- thick, solid surface material.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.
3. Fabricate countertops and backsplashes to dimensions, profiles, and details indicated.
4. Ease edges to radius indicated for the following:

a. Corners and Edges of solid surfacing: 1/16 inch.

E. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Drill holes in countertops for faucet and bubbler in the field per the Drawings.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 - "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

1. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 - "Joint Sealants."

I. Finish wood cleats or supports beneath countertops with a coat of clear varnish.

END OF SECTION 12 36 61

SECTION 13 34 19 – PREFABRICATED STORAGE BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Prefabricated wood storage buildings.

1.2 RELATED SECTIONS

A. Section 03 30 00 – CAST-IN-PLACE CONCRETE for cast-in-place floor slab.

B. Section 08 71 00 – DOOR HARDWARE for lockset requirements

1.3 REFERENCES

A. APA – The Engineered Wood Association

1. PRP-108 – Performance Standards and Policies for Structural-Use Panels
2. PFS PRP-133 - Performance Standards and Policies for Structural-Use Panels

B. American National Standards Institute (ANSI): ICC/ANSI A117.1-Accessible and Useable Buildings and Facilities.

1.4 DESIGN REQUIREMENTS

A. Provide factory built, prefabricated structures capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

B. Design Loads: Determine loads based on the following minimum requirements:

1. Uniform pressure of 40 lbf/sg ft, acting inward or outward (standard).
2. Wind Load:
   a. Basin Wind Speed: 130 MPH
   b. Exposure: C
3. Snow Load:
   a. Ground Snow Load: 48 psf
   b. Roof Snow Load: 36 PSF
4. Live Loads:
   a. Floor: 100 PSF
   b. Roof: 20 PSF (non-Reducible)

C. Seismic Performance: Provide factory built, prefabricated structures capable of withstanding the effects of earthquake motions determined according to:

1. ASCE 7, “Minimum Design Loads for Buildings and Other Structures”: Section 9, “Earthquake Loads”.

1.5 PERFORMANCE REQUIREMENTS

A. Cooperate with regulatory agency or authority and provide data as requested by authority having jurisdiction.

B. Prefabricated structures specified herein shall be handicapped accessible in accordance with ICC/ANSI A117.1 and other state and local requirements as applicable.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 30 00 – Administrative Requirements

B. Product Data: Manufacturer’s data sheets on each product to be used, including:

1. Construction details, material descriptions, dimensions of individual components and profiles and finishes.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Shop Drawings: Include plans, elevations, sections details, and attachments to other work.

D. Selection Samples: For each finished product specified, two complete set of color chips representing manufacturer’s full range of available colors, textures and patterns.

E. Warranty Documentation: For Warranty as specified herein.

1.7 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Company specializing in manufacturing prefabricated structures with a minimum documented experience of twenty years and with a documented quality assurance program.

B. Prefabricated Components: Comply with manufacturer’s published literature for products meeting indicated design loads in accordance with state and local requirements as applicable.

1.8 DELIVERY, STORAGE AND HANDLING

A. Store products per manufacturer’s recommendations until ready for installation.

B. Protect all components and accessories from corrosion, deformation, damage and deterioration when stored at the jobsite. Keep materials and components free from dirt and foreign matter.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (moisture, humidity, etc.) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 CLOSEOUT SUBMITTALS

A. Maintenance Data: For prefabricated storage buildings to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.11 WARRANTY

A. Provide manufacturer's minimum 7-year warranty on workmanship and materials.

PART 2 - PRODUCTS

2.1 PREFABRICATED STORGE BUILDINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide "Premier Tall Ranch" storage building manufacuere by Tuff Shed, Inc., (800) 289-8833.

1) Size: 16' X 20'
2) Floor Joists: 2x6 hot-dipped galvanized steel
3) Decking: ¾" interlocking engineered sheathing
4) Door: 6'x 7' roll-up steel door.
5) Provide heavy duty loading ramps.
6) 3" deep aluminum threshold.
7) Min. 7'-8" top plate height.
8) Walls: 2x4" wood studs @ 16" o.c., with exterior engineered sifing.
9) Min 4:12 vented roof with asphalt dimensional shingles
   a) Provide Limited Lifetime Warranty.

B. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 - "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install building level & plumb.

END OF SECTION 13 34 19

Technical Specifications
Volume 2

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SECTION 22 00 00 - PLUMBING

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and Section 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

B. This specification section lists general requirements for plumbing work and is hereby made a part of each Division 22 specification section.

C. For convenience or reference the Specifications are separated into Divisions and Sections. Such separations shall not operate to make the Engineer an arbitrator to establish subcontract limits between the Prime Contractor and his Subcontractors. In any case, the Prime Contractor is responsible to the owner for a complete project.

D. Wherever the word ‘provide’ is utilized with regard to materials or equipment on the drawings or in the specifications it shall be interpreted to mean ‘furnish and install’.

E. The term ‘exposed’ shall be interpreted to mean any equipment, ductwork, or piping that is not concealed above a continuous ceiling or inside a finished wall.

1.2 WORK INCLUDED

A. This section consists of general requirements and standard specifications covering certain parts of the plumbing work and is supplemented by other Division 22 specification sections covering additional work, requirements, and materials specifically applicable to the plumbing work of each section. Requirements of subsequent sections of the specifications, if in conflict with these general requirements, shall govern.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Provide work and materials in full accordance with the latest rules and regulations of the following:

2024 International Building Code
2024 International Existing Building Code (when applicable)
2024 Uniform Mechanical Code
2024 Uniform Plumbing Code
2024 International Energy Conservation Code
2023 National Electrical Code
2024 International Fire Code
2024 NFPA Codes and Standards
Nevada State Fire Marshal
Nevada Occupational Safety and Health
Underwriters Laboratories
All other applicable state codes, rules, and regulations

B. Nothing in the drawings or specifications shall be construed to permit work not conforming to the listed codes and regulations.

C. In the event of an inconsistency between or within the plans, specifications, any of the contract documents, codes, or regulations, the better quality, higher cost, and/or greater quantity of materials and work shall be provided at no additional cost to the Owner.

1.4 FEES, PERMITS, AND UTILITY SERVICES

A. Obtain and pay for all permits and service required for installation of this work; arrange for required inspections and secure approvals from the authorities having jurisdiction.

B. Arrange for utility connections and coordinate work with utility company.

C. Arrange required inspections and secure approvals from the authorities having jurisdiction.

1.5 SITE EXAMINATION

A. Examine site, verify dimensions and locations against drawings, and inform self of conditions under which work is to be done before submitting proposal. No allowance will be made for extra expense on account of error.

B. Information shown relative to existing services is based upon available records and data but is approximate only. Make minor deviations found necessary to conform with actual locations and conditions without extra cost. Verify location and elevation of utilities prior to commencement of excavation for new piping or its installation.

1.6 PLACEMENT OF EQUIPMENT AND WORK

A. The placement of equipment and mechanical work in the locations and spaces shown on the drawings is the Contractor's responsibility.

B. Move equipment and/or work into spaces through openings provided or located in the spaces during construction, as required.

C. Perform disassembling and reassembling of equipment or other work necessary to accomplish this requirement without extra cost to the Owner.

1.7 SUBMITTALS AND SUBSTITUTIONS

A. Submit to the Architect/Engineer for review, within a reasonable time after award of Contract and in ample time to avoid delay of construction, shop drawings or submittals on all items of equipment and materials, including all substitutions. Substitutions will be interpreted to be all manufacturers other than those specifically listed by model or catalog number. Also see Division 1 for additional related requirements.

B. Partial or incomplete sets of equipment and materials submittals will not be acceptable.

C. Only one request for substitution will be considered on each item of equipment or material. No substitutions will be considered thereafter.

D. Quantities are the Contractor’s responsibility and will not be reviewed.

E. All submittal data shall be tailored to suit the specific project, with appropriate model or part numbers, materials, sizes, options, and accessories clearly indicated for each different submittal item and on each submittal page. Submittal pages without this information will be returned and will need to be resubmitted with all of the required information indicated on each sheet.

F. The Contractor shall certify that he has examined all submittal data and that the equipment and materials submitted for review meet or exceed the requirements of the drawings and specifications. Submittals without the required certification will not be acceptable.

G. Electronic Formatted Submittals
   1. Provide submittals in electronic form (.pdf file format).
   2. Identify and incorporate submitted information, including a cover sheet, and the following:
      a. Project Name
      b. Submittal Package Number (with revision number identified)
      c. Date
      d. Name of Architect/Engineer
      e. Name of Contractor
      f. Name of Subcontractor
   3. Group submitted items by specification section, and provide the following:
      a. Index of submitted products with page numbers
      b. Name of Firm or entity that prepared submittal
      c. Name of Supplier
      d. Name of Manufacturer
      e. Equipment and/or fixture tag, if applicable
      f. Number and title of appropriate specification section
   4. Items indicated by the Architect/Engineer to be resubmitted shall be resubmitted as follows:
      a. Retain items marked as 'No Exceptions Taken' or 'Make Corrections Noted' and resubmit with the revised package. Do not provide new sheets for these items.
      b. Provide revised submittal sheets for all other reviewed items.
      c. Provide originally submitted sheet with Architect/Engineer comments.
      d. Clearly indicate amendments and modifications made in response to previous submittal review comments.

H. If the Contractor desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified. No substitutions will be allowed unless requested and reviewed in writing. The Architect/Engineer will review and take appropriate action on shop drawings, product data, samples, and other submittals as required by the contract documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the contract documents. The review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Architect/Engineer shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the Contractor, nor shall the Architect/Engineer be required to review partial submissions or those for which submissions for correlated items have not been received. The Architect/Engineer reserves the right to require the originally specified item.

I. Installation of reviewed substitutions is the Contractor's responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the Owner. Review by the Architect/Engineer of the substituted equipment and/or the dimensioned drawings does not waive the requirements stated herein.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Mention herein or on the drawings requires that the Contractor provide each item listed of quality noted or equal. All material shall be new, full weight, standard in all respects, and in first class condition. Provide materials of the same brand or manufacturer throughout for each class of material or equipment wherever possible. Materials shall be tested within the continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements.

B. The grade or quality of materials desired is indicated by the trade names or catalog numbers stated herein.

C. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without permission of the Architect/Engineer.

D. Provide factory-fabricated piping specialties and valves recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Contractor to comply with installation requirements. Provide sizes and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Contractor's option.

E. Unless otherwise indicated, provide valves of same size as upstream pipe size.

F. All equipment shall comply with the mandatory equipment efficiencies listed in International Energy Conservation Code Section C403.3.2.

G. No material installed as part of this work shall contain asbestos in any form.

2.2 MATERIALS FURNISHED

A. Identify all materials and equipment by the manufacturer's name and model number. Remove any unidentified materials and equipment from the site.

B. Equipment scheduled and/or specified by the manufacturer's model number shall include all accessories, controls, etc. listed in the catalog as standard with the equipment. Furnish optional or additional accessories as scheduled and/or specified.

C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged, and shall be replaced with new equipment. Variance from this requirement is permitted only with written consent of the Architect/Engineer.

D. Provide an authorized representative to constantly supervise the work of this division. Check all materials prior to installation for conformance with the drawings and specifications.

PART 3 - EXECUTION

3.1 ACCESS TO PLUMBING WORK

A. Comply with manufacturer's instructions for installation of access doors.

B. Access panels shall be furnished and installed wherever valves, balance valves, damper operating mechanisms, air terminal units, fans, and similar items normally requiring adjustment or servicing are installed in concealed or inaccessible spaces. Coordinate with access doors shown on architectural drawings.

C. Continuously check architectural drawings for clearance and accessibility of equipment specified herein to be placed. No allowance of any kind will be made for negligence on the part of the Contractor to foresee means of installing his equipment into proper position.

3.2 DRAWINGS AND COORDINATION

A. General arrangement and location of piping, ductwork, equipment, etc. are shown on the drawings or herein specified. Carefully examine other work that may conflict with this work. Install this work in harmony with other crafts and at proper time to avoid delay of work.

B. In advance of construction, work out minor changes and relocations to suit actual conditions and work of other trades to avoid conflict therewith. This effort shall not be cause for additional cost.

C. Verify all measurements at the building and be responsible for the correctness of same. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the drawings.

D. In addition, obtain all necessary information from the other trades regarding centers of partitions, walls, location of plumbing mains, fire sprinkler mains, and electrical conduits, ducts, pipes, etc. in order that pipes, equipment, and ductwork may be placed in their correct positions.

E. Execute any work or apparatus shown on the drawings and not mentioned in the specifications, or vice versa, the same as if specifically mentioned by both. Omission from drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve the Contractor of furnishing same in place complete.

F. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.

G. Furnish materials and work at proper time to avoid delay of the work.

3.3 AS-BUILT DRAWINGS

A. Upon completion of work submit to the Architect/Engineer as-built drawings showing all changes in equipment, piping, ductwork, etc. installed as part of this project which are not in accordance with the contract drawings. As-built drawing deliverables shall be in accordance with the requirements of Division 1, and shall consist of the following as a minimum.

1. Provide as-built drawings in electronic file format (pdf file). In addition to the electronic file, when field mark-ups have been utilized, provide a complete set of full size neatly and legibly marked as-built drawings on 20 pound white bond paper.
2. As-built drawings shall be full size (same size as the contract documents) and shall be standard engineering scale. The minimum drawing scale shall match those provided in the contract documents.
3. As-built drawings shall include all outside utility connections, piping, etc. installed under this Contract. Locate and dimension all work with reference to permanent landmarks.

B. Match all symbols and designations used in the contract drawings when preparing the as-built drawings.

C. Indicate clearly and correctly all work installed differently from that shown, and maintain records up to date as work progresses. Include invert elevations of pipes below grade of floor, the floor lines, plugged wyes, tees, caps, exact locations and sizing of piping, location of valves, and the like. Dimension locations from structural points.

D. Properly identify all stubs for future connections as to locations and use by setting of concrete markers at finished grade in manner suitable to the Architect/Engineer.

3.4 PROJECT MODIFICATIONS

A. During the progress of construction, if any conditions arise that necessitate revisions, modifications, or relocation of any plumbing equipment or materials, such revisions shall be immediately brought to the attention of the Architect/Engineer. The Contractor shall then prepare necessary drawings showing the proposed changes. All proposed changes shall be submitted, reviewed, and approved by the Architect/Engineer prior to proceeding with any associated revision work in the field.

B. Maintain copies of all approved changes at the project site for reference by all parties during the remaining work.

C. Incorporate all revisions into the as-built drawings.

3.5 CLOSING IN OF UNINSPECTED WORK

A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected and tested. Should work be enclosed or covered up before it has been inspected and tested, uncover work at own expense. After it has been inspected and tested, make repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.6 FORMING, CUTTING AND PATCHING

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this Contractor fails to coordinate with other contractors at proper time or fails to locate items properly, resulting in extra work, then this Contractor is responsible.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for work.

3.7 EXISTING SERVICES

A. Provide and install all required connections to existing systems as required by the drawings and specifications.

B. Integrate existing systems with all new work to provide a complete working system.

C. Provide minimum 48 hour notice to Owner of any service interruptions. All service interruptions shall be kept to the minimum possible time. When requested by Owner service interruptions shall occur outside of normal working hours.

D. The Contractor shall be responsible for damage to any part of the premises during the guarantee period that is caused by defects, leaks, or breaks in work furnished and/or installed under this section.

E. The Contractor shall replace refrigerant, lubricants, and/or gases lost as a result of defects, breaks, or leaks in the work.

3.8 PROJECT COMPLETION TESTS AND START-UP

A. Upon completion of the plumbing work, or at such time prior to completion as may be determined by the Architect/Engineer, operate and test all plumbing equipment and systems for a period of at least three consecutive 8 hour days to demonstrate the satisfactory overall operation of the building or project as a complete unit. Commence tests after preliminary balancing and adjustments to equipment have been checked. Notify the Architect/Engineer at least seven calendar days in advance of starting the required tests.

B. Provide training and orientation of Owner’s operating staff in proper care and operation of all plumbing equipment, systems, and controls.

C. Neatly tabulate and deliver to the Architect/Engineer complete operational data. The Architect/Engineer reserves the right to spot check results, and if discrepancies or errors are noted, the Contractor will be required to redo balancing tests and tabulations entirely.

D. During the test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in a first class operating condition.

E. Mark final positions of balancing valves after balancing is complete.

F. Final observation will not be conducted until all of the above requirements have been completed and the balance report has been submitted and reviewed.

3.9 WARRANTY/GUARANTEE

A. The Contractor shall be responsible for all work done and material installed under the plans and specifications. Repair or replace, as may be necessary, any defective work, material, or part which may show itself within one year of filing of the Notice of Substantial Completion and be responsible for damage to other materials, furnishings, equipment, or premises caused by such defects during this period, if in the opinion of the Architect/Engineer said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to the Owner.

B. The Contractor shall be responsible for damage to any part of the premises during the guarantee period that is caused by defects, leaks, or breaks in work furnished and/or installed under this section.

3.10 ELEVEN MONTH WARRANTY INSPECTION

A. Prior to the end of the one year warranty period (approximately 11 months after the date of the Certificate of Substantial Completion and prior to the one year warranty end date) the Contractor shall schedule a date with the Owner and the Engineer to conduct a thorough review of the plumbing systems and equipment, and provide follow-up operating and maintenance re-training (where requested by the Owner). All major Subcontractors associated with the plumbing work shall attend the operating and maintenance re-training and warranty inspection sessions. The Contractor shall video any follow-up operating and maintenance re-training that is requested by the Owner and provide electronic copies to the Owner and the Engineer. The Contractor shall take immediate action to remedy any warranty items identified during the warranty inspection, at no cost to the Owner. Provide a minimum of 14 days advance notice of the proposed date for the warranty inspection and operating and maintenance re-training sessions.

3.11 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 05 00 - BASIC MATERIALS AND METHODS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 220000 (Plumbing) is hereby made a part of this section.

B. This section provides requirements for basic materials and methods related to all of the Plumbing work. This section applies to all other Division 22 specification sections.

1.2 WORK INCLUDED

A. Types of Plumbing related work specified in this section include the following:

1. General Materials
2. Hangers and Supports for Plumbing Systems
3. Seismic Bracing for Plumbing Systems
4. Valves
5. Access Doors and Panels
6. Roof and Wall Flashings
7. Unions and Flanges
8. Cathodic Protection
9. Thermometers
10. Pressure Gauges
11. Pipe Escutcheons
12. Pipe Sleeves
13. Pipe Sleeves with Mechanical Sleeve Seals
14. Strainers
15. Flow Meters
16. Penetrations in Fire and Smoke Rated Partitions
17. Piping and Equipment Identification
18. Tracer Wire and Warning Tape for Below Ground Piping
19. Painting
20. Concrete Work
21. Electric Motors
22. Electric Motor Starters

1.3 PROJECT CONDITIONS

A. Existing Utilities: Locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of valves and piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Valve Types: Provide valves of same type by the same manufacturer.

C. Identification: Provide valves and piping specialties with the manufacturer's name or trademark and pressure rating clearly marked on the valve body.

1.5 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each type of manufactured valve and piping specialty. Include pressure drop curve or chart for each type and size of isolation valve, balancing valve, and control valve.

B. Operation and Maintenance Data: Submit operation and maintenance data and spare parts lists for each type of manufactured valve and piping specialty. Include this data and product data in the operating and maintenance manual in accordance with all associated requirements.

C. All interface requirements (BACnet or other) shall be coordinated with the temperature control system subcontractor prior to issuing submittals and/or ordering any equipment that is required to have an interface.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

A. Provide factory-fabricated valves and piping specialties as recommended by the manufacturer for use in the service indicated. All valves, fittings and accessories installed in potable water systems shall be rated for such use. Provide piping specialties of types and with pressure ratings indicated for each type of service, or if not indicated, provide proper selection as determined by the Contractor to comply with the installation requirements. Provide sizes and connections which properly mate with piping, tubing, and equipment connections.

B. Unless otherwise indicated, provide valves of the same size as the upstream pipe size.

C. All valves, fittings, and accessories located in potable water systems shall be constructed of appropriate materials and conform to the requirements of NSF/ANSI Standards 61 and 372.

2.2 HANGERS AND SUPPORTS FOR PLUMBING SYSTEMS

A. See Specification Section 220530 (Hangers and Supports for Plumbing Systems).

2.3 SEISMIC BRACING FOR PLUMBING SYSTEMS

A. See Specification Section 220540 (Seismic Bracing for Plumbing Systems).

2.4 VALVES

A. See Specification Section 220510 (Valves for Plumbing Systems).

2.5 ACCESS DOORS AND PANELS

A. Where floors, walls, or ceilings must be penetrated for access to plumbing equipment, provide access doors with 14 inch by 14 inch minimum usable opening. Where entry of service personnel may be required, provide a 22 inch by 30 inch minimum usable opening.

B. Access doors shall match those shown on the architectural plans or in the architectural specifications (typically in Division 8) unless noted otherwise herein.

C. Where specific information or details relating to access panels different from the above is shown or given on the drawings or in other divisions of work, then that information shall supersede this specification.

D. Where access panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

E. Provide insulated access doors where located in internally insulated ducts or casings.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering access doors which may be incorporated in the work include Milcor, Best, or approved equal:

Milcor Style M	Drywall and/or Masonry
Milcor Style K	Plaster
Milcor Style UFR	Fire Rated (where required)

2.6 ROOF AND WALL FLASHINGS

A. Flashing for penetrations of the roof for plumbing items such as pipes and flues shall be as indicated on the drawings and in these specifications. Where exterior sheet metal flashings are indicated on the drawings or details, the flashings shall be galvanized sheet metal. The work of this section shall include layout, sizing, and coordination of roof and wall penetrations with all trades. Flues shall have a minimum 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.

B. Sewer vents and other plumbing piping terminating above a non-membrane type roof shall have a metal roof flashing and counter-flashing manufactured by Oatey, Stoneman, or approved equal.

2.7 UNIONS AND FLANGES

A. Furnish and install unions at each threaded or soldered connection to all equipment, tanks, etc. Unions shall be in accordance with the following listing:

Type of Pipe	Union
Threaded steel 2" and smaller	150 lb threaded malleable ground joint, brass to iron seat, black for black piping, galvanized for galvanized piping.
Threaded steel 2-1/2" and larger	125 lb cast iron threaded flanged union, flat faced, gasket, black for black piping, galvanized for galvanized piping.
Copper tubing 2" and smaller	150 lb bronze ground joint, bronze to bronze sweat connection.
Copper tubing 2-1/2" and larger	150 lb cast bronze, flat faced flange with silver brazing threadless ends.

B. Insulating couplings or flanges shall be furnished and installed at all connections of piping with dissimilar materials. Construct couplings so that the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Heavily line the couplings with a hard, insulating, phenolic threaded coupling in standard pipe sizes.

C. Furnish and install flanges at each flanged connection to equipment, tanks, and valves per following schedule:

Type of Pipe	Flanges
Threaded steel pipe 2-1/2" and smaller	125 lb threaded cast iron, flat face flange, black or galvanized steel as applicable.
Welded steel pipe 2-1/2" and larger	150 lb welded forged steel, raised face flange.

D. Provide full faced or ring type gasket material to suit facing on flanges. Gasket material shall be 1/16" thick Garlock Blue-Gard, or approved equal. Gasket material shall be suitable for the connected piping system content and temperature.

2.8 CATHODIC PROTECTION

A. Furnish and install dielectric unions at all locations described herein, whether shown on drawings or not. Construct couplings and flanges so that the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Couplings shall be lined with a hard, insulating, phenolic plastic threaded in standard pipe sizes.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following, or approved equal:

Nibco
Legend
Zurn
Watts

2.9 THERMOMETERS

A. Thermometers shall be of the bimetal helix type, Miljoco Model B5098A, or approved equal by Weiss or Weksler. Thermometers shall be accurate to within plus or minus 1% throughout the entire scale range. Scales shall have a minimum of 2 degrees between graduations and a maximum of 20 degrees between figures.

B. Thermometers shall be 5 inch diameter with polycarbonate lens, stainless steel case and ring, stainless steel stem, and stainless steel well. Thermometer stem length for piping shall be 2-1/2 inches, and stem length for tanks shall be 9 inches. Thermometers installed on insulated tanks or piping shall be provided with an extension neck well to compensate for the thickness of the insulation.

C. Thermometer ranges shall be as listed below.

Location	Range
Cold water piping mains	25° to 125°F
Hot water piping mains	0° to 250°F

D. Thermometers shall include an adjustable bracket allowing rotation to any position, and shall be located such that they are easily read from a normal vantage point.

2.10 PRESSURE GAUGES

A. Pressure gauges shall be flangeless case type, Miljoco Model P4598L, or approved equal by Weiss or Weksler. Gauges shall be accurate to within plus or minus 1% throughout the entire scale range. Scales shall have a minimum of 2 degrees between graduations and a maximum of 20 degrees between figures.

B. Pressure gauges shall be 4-1/2 inch diameter with acrylic lens, stainless steel case, and stainless steel ring. Gauge movement shall be brass with precision-milled teeth. Gauges shall be selected with a pressure range such that the gauge reads near the middle of the total gauge range at the pressure indicated on the drawings.

2.11 PIPE ESCUTCHEONS

A. Provide chrome plated brass pipe escutcheons with inside diameter closely fitting pipe outside diameter or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, ceilings, or pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish and screw or spring clamping device with concealed hinge.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe escutcheons which may be incorporated in the work include the following, or approved equal:

Chicago Faucets
Pasco Specialty and Manufacturing
Sanitary Dash

2.12 PIPE SLEEVES

A. Where pipes pass through exterior walls above grade and/or through concrete floors install a Schedule 10 galvanized metal sleeve providing between a 1/2” and 1” clearance around the sides of the pipe. The pipe shall be covered with high density fiberglass insulation. Pipe insulation shall be 1/2” to 1” thick Johns Manville Microlok HP or Johns Manville Trymer 25-50 for the full thickness of the concrete. After the piping has been installed, the fiberglass insulation shall be cut away or compressed leaving a 1/2” deep space that shall then be filled with a high quality silicone sealant resulting in a flat, water-tight installation.

B. Where pipes pass through fire rated walls above grade or fire rated concrete floors install a Schedule 10 galvanized metal sleeve providing between a 1/2” and 1” clearance around the sides of the pipe and/or pipe insulation for the full thickness of the concrete. After the piping has been installed, fill the annular space with a 3M sealant in accordance with the applicable UL fire rating system.

2.13 PIPE SLEEVES WITH MECHANICAL SLEEVE SEALS

A. Provide mechanical sleeve seals for pipe sleeves located in foundation walls below grade and/or in exterior walls below grade as follows:

1. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing a water-tight seal.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe sleeves with sleeve seals which may be incorporated in the work include the following, or approved equal:

   Thunderline Link-Seal
   Calpico

2.14 STRAINERS

A. Provide wye strainers as indicated on the drawings. Strainers shall be full line size of connecting piping, with ends matching the piping system materials, and with cast iron body. Select strainers for 125 psi working pressure, with stainless steel screens, and gasket seal. Provide hose end ball valve on the drain fitting.

B. Strainer screens shall have an open area equal to at least twice the cross-sectional area of the pipe in which they are installed (based on IPS) and may be either woven wire or perforated type. Strainer openings shall be .045 inch diameter perforations for strainers up to 3” size and .125 inch diameter perforations for strainer sizes 4” and larger.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering low pressure strainers which may be incorporated in the work include the following, or approved equal:

   Zurn
   Watts
   Metraflex

2.15 FLOW METERS

A. Flow Meters for Domestic Water Make-Up: When shown on the drawings, provide ultrasonic style flow meters, Belimo Model FM100, or approved equal. Turbine type flow meters are not acceptable. Flow meters shall be installed in strict conformance with the manufacturer’s installation instructions, including required straight pipe length upstream and downstream of the flow meter. Flow meters shall be certified under NSF/ANSI Standard 61 for use in a potable water system.

B. Flow Meters for Domestic Cold Water Mains (Monitored): When shown on the drawings, provide Seametrics Model iMag4700 electromagnetic flow meters. Turbine type flow meters are not acceptable. Flow meters shall be installed in strict conformance with the manufacturer’s installation instructions, including required straight pipe length upstream and downstream of the flow meter. Flow meters shall be certified under NSF/ANSI Standard 61 for use in a potable water system. Water flow meters shall be interfaced with and monitored by the direct digital control system

C. Flow Meters for Domestic Cold Water Mains (Non-Monitored): When shown on the drawings, provide Seametrics Model MJNE brass body flow meter, with hall-effect sensing, or approved equal. Flow meters shall be certified under NSF/ANSI Standard 61 for use in a potable water system.

2.16 PENETRATIONS IN FIRE AND SMOKE RATED PARTITIONS

A. Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe, conduit, and duct penetrations. Seal all penetrations with fire-stop and smoke-stop materials complying with the requirements for firestopping and fill materials specified in this section.

B. Schedule and conduct a firestopping pre-installation conference at the job site. Coordinate all firestopping means and methods with other contractors and the general contractor (when applicable) prior to beginning any work.

C. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 (Approval of Firestop Contractors), or been evaluated by UL and found to comply with their ‘Qualified Firestop Contractor Program Requirements’.

D. Install all penetration firestopping systems to comply with the manufacturer's written installation instructions and published drawings for products and applications.

E. Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by the penetration firestopping system manufacturer or when substrates are wet because of rain, frost, condensation, or other causes.

F. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilation, or where this is inadequate, forced-air circulation.

G. The specified firestopping systems are based on a solid sealant only, or combinations of solid sealant, foam sealant, and refractory fibers of thickness required to attain hour ratings.

H. Systems shall comply with the following:
   1. Provide a flexible seal to prevent passage of fire, smoke, toxic gases, and water through openings, and prevent transmission of sound and vibration from the penetrating element to the structure.
   2. Provide hour ratings indicated and in accordance with ASTM E 814 and/or UL 1479.
   3. For projects located in the State of California comply with requirements of CBC Sections 709.6, 709.7, 709.8, 710.2, 710.3 and 710.6, and CBC Standards 7-1 and 7-5.

I. Acceptable Manufacturers: 3M, Hilti, Nelson, Specified Technologies, Tremco, Roxtec, or as otherwise specified. The established standard in most cases is 3M, unless otherwise specified. The listed products are specified to establish standards and the type of materials required. Materials shall be as specified, or approved equal.

J. Sealant: Select among the following materials as appropriate for the application.
   1. Solid (Elastomeric): 3M Fire Barrier Premium Latex CP 25WB+ Caulk, one-component elastomeric water-based latex sealant designed for use as a through-penetration firestop.
   2. Foam: 3M Fire Barrier 2001 Silicone RTV Foam, two-component silicone elastomer foam-in-place sealant designed to fill irregular or complex voids.
   3. Wrap Strip: 3M Fire Barrier FS-195+ Wrap Strip, fire resistive strip designed to be wrapped around the penetrating item and secured in place.
   4. Restricting Collar: 3M Fire Barrier RC-1 Restricting Collar, sheet metal, designed for use with wrap strip in combustible through-wall firestop penetration systems.
   5. Composite Sheet: 3M Fire Barrier CS-195+ Composite Sheet, elastomeric layer reinforced with mesh restraining wire and covered with aluminum foil on one side and bonded to sheet metal, forming a fire resistive sheet.
   6. Putty: 3M Fire Barrier MP Moldable Putty+ Pads and Sticks, one-component elastomeric formable putty, designed for use as a through-penetration firestop system.

7. Spray: 3M FireDam Spray 100, flexible water-based coating.
8. Primers: As recommended by the sealant manufacturer.

K. Pillows: Nelson PLW Firestop Pillow, Hilti FS Fire Block, dust proof chemical resistant cloth with heat-reactive expanding solidifying fill, designed for large openings that require frequent cable alterations.

L. Safing Insulation: USG Thermafiber Safing Insulation, 4 lb density mineral wool insulation, unless indicated otherwise.

2.17 PIPING AND EQUIPMENT IDENTIFICATION

A. Each piping system furnished and installed under this work shall be identified and the direction of flow indicated by means of colored labels and flow arrows, all as specified herein. The labels shall be applied after all painting, priming, and cleaning of the piping and insulation is completed.

B. Provide prefabricated coiled plastic piping labels as manufactured by Marking Services Incorporated (MSI), or approved equal. Labels shall comply with the most current edition of ANSI/ASME Standard A13.1 with regard to color, letter height, and marker size. The labels shall have black or white lettering and flow arrows on colored backgrounds and shall not require adhesive.

C. The label background colors shall conform to the color schedule in the ‘Execution’ section of this specification.

1. For pipe labels used indoors use coiled polyester labels, MSI Model MS-975, or equal.
2. For pipe labels used outdoors use coiled polyester labels, MSI Model MS-995, or equal.
3. For piping with an outside diameter, including insulation, greater than 6 inches provide the label manufacturer’s nylon straps to secure label to piping. Labels shall lie smoothly against pipe or insulation completely around the pipe.
4. The size of the lettering and label shall be such that the lettering can be easily read from the floor and the colors shall be easily discernible.

D. Provide a white plastic lamacoid plate for each and every piece of equipment installed in this work. Lettering on plate shall be black, with size of lettering to suit equipment. Lettering shall be a minimum of 1/2 inch in height. Plates shall be riveted or bolted to equipment near electrical disconnect or control access panel.

E. Where mechanical or plumbing equipment requiring access is located above a ceiling or behind an access panel, provide an adhesive clear plastic label with 3/8” black lettering on the ceiling grid or access panel identifying the equipment.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the Work include the following, or approved equal:
Marking Services Incorporated (MSI)

LEM Products
Seton
Craftmark

2.18 TRACER WIRE AND WARNING TAPE FOR BELOW GROUND PIPING

A. Protect the following underground piping (when shown on the mechanical and/or plumbing drawings) with tracer wire and underground warning tape. Tracer wire shall be No. 14 AWG Pro-Trace Model HF-CCS-PE30, or approved equal. Warning tape shall be Seton Detectable Underground Warning Tape, or approved equal. Warning tape shall be a minimum of 5 mils thick with aluminum backing.

1. All non-metallic water, waste, and gas piping.

B. Jacket color and labeling shall be specifically matched to the piping below.

C. Tape shall be buried approximately one half of the pipe buried depth, and in strict accordance with the manufacturer's written installation instructions.
   1. Tape buried up to 24" deep shall be a minimum of 4" wide.
   2. Tape buried greater than 24" deep shall be a minimum of 6" wide.

D. The procedure for locating the installed tracer wire shall be demonstrated to the Owner and Engineer by the Contractor utilizing an appropriate locating device. Locating device shall be Ridgid 'Seetech', Ridgid 'Navitrack', or approved equal.

2.19 PAINTING

A. In general, painting will be done by others. Exposed piping and unfinished portions of equipment to be painted shall be cleaned by this Contractor of grease, oil, rust, or dirt in preparation for painting. Spot prime all factory primed surfaces as necessary to repair any damage to finish.

2.20 CONCRETE WORK

A. Where specifically indicated on the drawings or specified as part of the plumbing work, this Contractor shall furnish and install concrete work such as thrust blocks and/or spring isolator bases.

B. Concrete and reinforcing steel shall be equal to that specified for general construction.

C. Except as noted above, concrete work will be furnished and installed by others. This Contractor shall coordinate all requirements accordingly.

2.21 ELECTRIC MOTORS

A. Electric motors larger than 1/2 horsepower rating, unless otherwise noted, shall be ball bearing, open drip proof, squirrel cage, induction type, normal starting torque, 3 phase, 60 cycle service, 40°C continuous rating, and shall conform in all respects to latest applicable standards of NEMA and AIEE. Motors shall be Century, Louis Allis, Baldor, or equal. Motors located outdoors shall be TEFC type.

B. All motors 1 horsepower and above shall be high efficiency type, Century E-Plus, or approved equal.

C. Motors utilized with variable frequency drives shall be rated as inverter duty per NEMA standards.

D. Motors shall have nameplate voltage rating of operating voltage specified in subsequent sections of specifications or as shown on drawings and shall have a 1.15 service factor.

E. For normal applications, motors shall be furnished for normal starting torque duty. It shall be this Contractor's responsibility, however, to provide motors and starters (where starters are furnished under this section) having suitable starting torque and current characteristics to allow starting the equipment within the branch circuit protection provided and within the overload protection required by code.

F. Splash-proof or totally enclosed motors having a continuous duty temperature rise rating not exceeding 35°C shall have adequate starting torque, as recommended by the manufacturer, for the service intended.

G. All motors shall be rated at ±10% of the scheduled voltage. If not, provide each motor with a boost transformer sized for the intended use and installed in a rated enclosure.
   1. Boost transformers for equipment provided under the plumbing work shall be furnished by the plumbing contractor and turned over to the electrical contractor for installation, unless otherwise noted.

H. Shaft Grounding:

1. All variable frequency drive motors less than 300 horsepower shall have a single shaft grounding system to protect the bearings from capacitive discharge through the bearings.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following, or approved equal:

   CR Series by Shaft Grounding Systems
   AEGIS SGR Conductive Microfiber Brush

2.22 ELECTRIC MOTOR STARTERS

A. Magnetic motor starters for equipment provided under the plumbing work shall be furnished by the plumbing contractor and turned over to the electrical contractor for installation, unless otherwise noted. All motor starters shall be by the same manufacturer, Westinghouse, Square D, Cutler-Hammer, General Electric, or approved equal.

B. Magnetic motor starters provided as part of motor control centers shall be provided and installed by the electrical contractor.

C. Submit schedule to the Architect/Engineer denoting the following:

1. Designation of each motor
2. Name plate rating of each motor
3. Running current of each motor
4. Catalog number and rating of starter overload elements
5. Circuit breaker trip size (when in combination starter)

D. Unless otherwise noted, magnetic motor starters shall be furnished in a NEMA 1 enclosure for inside installation and in a gasketed NEMA 4 enclosure for outside installation, with three thermal overloads for three phase motors and one overload element for single phase motors. All overloads shall be ambient compensated.

E. Combination magnetic starters shall be Westinghouse Type A206 with circuit breaker disconnect and trip size of breaker as required for motor size, or as otherwise noted.

F. Magnetic motor starters shall be Westinghouse Type A200, or approved equal.

G. Manual motor starters shall be Westinghouse Type MST01 less enclosure, or approved equal.

H. Magnetic motor starters shall be provided with cover-mounted Hand-Off-Auto ‘Oil-Tight’ type switches as scheduled with integral fused 120 volt single phase control transformers.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Perform excavation required for installation of piping, service lines, and other work as indicated on the drawings. Verify location and elevation of all existing utilities prior to excavation for installation of new piping.

B. Excavations shall be of open vertical construction of sufficient width to provide free working space at both sides of the trench and around piping as required for joining, caulking, backfilling, and compacting.

C. Where invert elevations are not shown, dig trenches in accordance with the following:

   Exterior Water Piping (36 inches minimum cover)
   Gas Piping (18 inches minimum cover)

D. Dig trenches straight and true to line and grade with holes for bells for bell-and-spigot pipe. Evenly support piping for its entire length upon outside periphery of lower one third of pipe.

E. Where rock is encountered, undercut trenches by 3 inches, and fill with well tamped clean sand or pea gravel as required to correct pipe elevation.

F. After piping in the excavation has been installed and tested, backfill excavation to a point 6 inches above the piping using utility sand or pipe sand that is free of rocks and debris. Proceed evenly on both sides of the pipe and continuously tamp. Except as hereinafter noted, backfill more than 6 inches above the top of the pipe shall be made by using earth from the excavation placed in layers of 6 inch maximum depth. Compaction of each successive layer shall be achieved using a mechanical compactor.

G. Special care shall be taken when backfilling over and around wrapped or pre-insulated piping to prevent damage to the protective wrap and/or insulation.

H. Any backfill which subsides or settles below the adjacent finished grade or paving level during the guarantee period shall be brought to grade by the Contractor by adding compacted backfill or additional paving in paved areas.

I. See drawings and trench detail(s) for additional information and requirements.

3.2 ACCESS TO PLUMBING WORK

A. Comply with manufacturer's instructions for installation of access doors.

B. Access panels shall be furnished and installed wherever valves, balance valves, damper operating mechanisms, air terminal boxes, fans, and similar items normally requiring adjustment or servicing are installed in concealed or inaccessible spaces. Coordinate with the access doors shown on the architectural drawings.

C. Where access panels are detailed on architectural or plumbing drawings, sizes indicated thereon shall be used.

D. Where access panels are to be located in acoustic tile ceilings, the size of the access panel required shall be increased to properly fit the tile pattern without cutting into the tile.

3.3 FORMING, CUTTING, AND PATCHING

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of the plumbing work.

B. If this Contractor fails to coordinate with other contractors at the proper time or fails to locate items properly, resulting in extra work, the Contractor is responsible for the additional work, at no cost to the Owner.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for all work.

D. Cutting, patching, and repairing of existing (prior) construction to permit installation of piping, conduit, etc. is the responsibility of the Contractor. Repair or replace any damage that occurs to existing work in a first class manner using skilled mechanics for each trade involved.

E. Cut existing construction in a neat and workmanlike manner by the use of a concrete saw. Use of pneumatic devices is not acceptable.

F. Core openings through existing construction as required for the passage of any new piping and/or conduit. Cut holes of the minimum diameter required to suit the size of the pipe to be installed, including the associated insulation.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Sections 220530 (Hangers and Supports for Plumbing Systems) and 220540 (Seismic Bracing for Plumbing Systems).

B. Where special hanging or support of piping or equipment is detailed or shown on the drawings, the drawings shall be followed.

3.5 INSTALLATION OF VALVES

A. See Specification Section 220510 (Valves for Plumbing Systems).

3.6 INSTALLATION OF GAUGES

A. Provide gauge connections at the following locations:

Suction and discharge of domestic hot water recirculating pumps.
Elsewhere as shown on the drawings.

B. Gauges shall be provided in convenient locations within approximately 3 feet of the flanges or connections, and elsewhere as shown on the drawings.

3.7 INSTALLATION OF THERMOMETERS

A. Thermometers for piping systems shall be installed so that the liquid flows completely around the sensing well. Pipe sizes at the bulb shall be increased where necessary to allow for full flow without excessive resistance.

B. Thermometers shall be placed at all locations shown on the drawings.

C. In cases where the specified thermometers cannot be located so as to be easily read, a remote reading type thermometer shall be installed, as approved by the Architect/Engineer.

3.8 INSTALLATION OF CATHODIC PROTECTION

A. Install dielectric unions in the following locations:

1. In all metallic water and gas service connections to the building within 5 feet of the building wall. Install adjacent to the shutoff valve and above ground wherever possible.
2. At points of connections where copper water lines connect to steel domestic water heater tanks and other equipment.
3. At points in piping where dissimilar metal pipes are connected together.
4. Any special applications shown on the drawings.

B. Where steel or cast iron pipe in the ground connects to copper or brass piping above the ground, the transition from steel or cast iron pipe to the copper or brass pipe shall be made above ground in all cases and in an accessible location where practicable.

C. Where copper or brass piping is connected to steel or cast iron piping and the connection is buried in the ground, the connection shall be covered with coal tar protective tape as specified in section ‘Pipes And Pipe Fittings’ extending outward a minimum of 5 feet on all pipes from the point of connection. The tape shall have a minimum thickness of 10 mils and a maximum thickness of 12 mils and shall be applied so as to provide at least two full thicknesses of tape over the piping. A primer specifically designed for use with the tape, shall be used. The piping shall be thoroughly cleaned before any tape or primer is applied.

C. Gauge Valves and Siphons

1. A needle point globe valve, Crane No. 88 or equal, shall be installed at each gauge.
2. A gauge siphon shall be installed at each hot water gauge.

3.9 INSTALLATION OF PIPE IDENTIFICATION

A. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.

B. The legend and flow arrow shall be applied at all valve locations, at all points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction, and at approximately 20 foot intervals on pipe runs.

C. Practical variations or changes in locations and spacing may be made with the specific approval of the Architect/Engineer to meet specific conditions.

D. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.

E. Markings shall be located to be conspicuous from any reasonable vantage point.

F. The legends and flow arrows shall be in the colors as indicated in the pipe marking schedule.

G. Pipe labels shall be as described in Section 2.20 of this specification (Piping and Equipment Identification).

H. Pipe Marking Schedule (Based on ANSI/ASME Standard A13.1-2023)

Service	Color
Domestic Cold Water	White Text on Green Background
Domestic Hot Water	Black Text on Gray Background

I. Where different equipment such as fire sprinklers are supplied from a common main, such as a domestic water main, the main should be identified as ‘Domestic Water’ and each respective branch takeoff as ‘Fire Water’, etc.

J. Legacy Identification Schemes (Existing Facilities and Renovation Work): In existing facilities where the piping identification was previously labeled based on an earlier edition of ANSI/ASME Standard A13.1 (including the 1996 edition or the 2020 edition), the existing color scheme may be continued for renovation, alteration, and tenant improvement work, in accordance with the most current edition of ANSI/ASME Standard A13.1, provided that both of the following conditions are met:

1. The existing scheme is described in writing and made available to building operation and maintenance personnel, or affected employees are trained on the operation and hazards of the piping systems; and
2. The existing scheme is applied consistently throughout the affected systems within the facility. Where new piping systems are introduced into an existing facility under this work, the new piping shall be labeled in accordance with the existing facility scheme to maintain consistency, and the Contractor shall coordinate with the Owner to confirm the applicable scheme prior to ordering labels.

3.10 INSTALLATION OF FLASHINGS

A. Provide pipe flashings as noted on the drawings.

B. Flue and duct flashings and storm collars shall be securely clamped around flue and/or duct storm collars or counter-flashings.

3.11 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole and is flush with adjoining surface.

B. Sleeves: Secure sleeves to metal or wood forms in such a manner that they will not become displaced during pouring of concrete. Fill sleeves on deck with sand. After forms have been removed from concrete, the sleeves shall be removed from the openings.

C. Core drill properly sized holes in the concrete to replace metal sleeves that are crushed or knocked out of position during pouring of concrete.

D. Provide piping passing through concrete fire walls with sleeves of standard black steel pipe nominally one size larger than pipe enclosed, but in the case of insulated pipe, large enough for insulation to pass through. Caulk space between pipe and sleeve with fire-rated wicking, and provide metal retainer plates at both sides of the wall.

3.12 INSTALLATION OF WYE STRAINERS

A. Install wye strainers full size of the pipeline and in accordance with the manufacturer's installation instructions. Install pipe nipple and shutoff valve in the strainer blowdown connection, full size of the connection, except for strainers 2 inch and smaller installed ahead of control valves feeding individual equipment. Where indicated, provide a drain line from the shutoff valve to the nearest plumbing drain, same size as the blowdown connection.

B. Locate strainers in the supply line ahead of all pumps, temperature control valves, pressure reducing valves, temperature and pressure regulating valves, and elsewhere as indicated on the drawings if an integral strainer is not included with the equipment.

3.13 DEMOLITION WORK

A. Demolition work shall be performed only where specifically identified on the drawings. Unless specifically indicated otherwise, demolition work shall include removal of all associated equipment, electrical and controls components, conduit and wiring, piping, valves and accessories, and supports. The surfaces where the demolition work was performed shall be restored to match the adjacent surfaces to the best extent practical.

B. When demolition work involves leaving existing systems in place for a prolonged time period (more than 30 days and/or any time period when there is the potential for freezing temperatures) the Contractor shall protect all existing equipment, piping, and ductwork from potential damage during the time that the equipment, piping, and ductwork is out of service.

C. The protection procedures shall include draining all hydronic coils and the associated piping systems that may be susceptible to freezing temperatures when the building heating system is disabled. This requirement applies to both hydronic piping and domestic water piping systems.

D. After the piping systems are drained, the Contractor shall purge all water from the hydronic coils, hydronic piping systems, and domestic water piping systems using compressed air or other appropriate means, and shall seal any open ends such that the potential for corrosion is minimized. This work shall be performed by an experienced mechanical or plumbing contractor, rather than by a demolition contractor.

3.14 ELECTRICAL WORK

A. Adequate working space shall be provided around electrical equipment in compliance with the National Electrical Code and other applicable codes. Plumbing work shall be coordinated with the electrical work in order to comply with these requirements. Any work which does not conform to these requirements shall be corrected without additional cost to the Owner.

B. Furnish and install all line and low voltage control wiring in the plumbing work, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Unless noted otherwise, this does not include primary control wiring between starters and pushbuttons, or other manual starter switches.

C. Electrical Coordination

1. Starters located in motor control centers will be provided under the electrical work. The Contractor is referred to the electrical drawings for motors served by motor control centers.
2. Motors furnished under the plumbing work shall be furnished by the plumbing contractor, but connection to power wiring shall be by the electrical contractor. Coordinate all motor starter requirements with the electrical contractor.

D. Equipment furnished in this work that is factory-wired but requires modification to internal wiring to meet specifications or drawing requirements shall have such internal modifications made at the factory before shipment.

E. All electrical work and equipment, including internal wiring, shall comply with applicable codes and applicable portions of the electrical specifications. Route line and low voltage control wiring in conduit.

3.15 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. At completion, carefully clean and adjust all equipment and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.16 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.17 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 05 10 - VALVES FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of valves specified in this section include the following:

- Ball Valves
- Check Valves
- Manual Balance Valves
- Automatic Pressure-Compensating Balance Valves
- Motor Operated Valves
- Automatic Air Vent Valves
- Manual Air Vent Valves
- Pressure Relief Valves
- Temperature and Pressure Relief Valves
- Pressure Reducing Valves
- Valve Tags

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of valves and piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Valve Types: Provide valves of the same type by the same manufacturer.

C. Identification: Provide valves and piping specialties with the manufacturer's name or trademark and pressure rating clearly marked on the valve body.

1.4 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each type of valve and piping specialty. Include a pressure drop curve or chart for each type and size of isolation valve, balancing valve, and control valve.

B. Operation and Maintenance Data: Submit operation and maintenance data and spare parts lists for each type of manufactured valve and piping specialty. Include this data and product data in the operating and maintenance manual in accordance with all associated requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide factory-fabricated valves and piping specialties as recommended by the manufacturer for use in the service indicated.

B. All valves, fittings, and accessories located in potable water systems shall be constructed of appropriate materials and conform to the requirements of NSF/ANSI Standards 61 and 372.

C. Unless otherwise indicated, provide valves of same size as the upstream pipe size.

D. Provide valves of type and with pressure ratings indicated for each service, or if not indicated, provide a proper selection to comply with the installation requirements. Provide sizes and connections which properly mate with piping, tubing, and equipment connections.

2.2 VALVES

A. Provide factory-fabricated valves of type and with pressure rating as indicated for each service, or if not indicated, provide proper valve selections complying with the installation requirements. Provide sizes and connections which properly mate with the pipe, tube, and equipment connections.

B. Unless otherwise indicated, valves shall be the same size as the upstream pipe size.

C. Provide valves as shown on drawings and as necessary to segregate piping branches and equipment. Furnish the flow performance curve for each valve.

D. Furnish discs suitable for the service intended. Properly pack and lubricate all valves per the valve manufacturer's recommendations.

E. Provide flanged valves in welded pipe, and provide ball valves in water lines, unless otherwise indicated on the drawings.

F. Valves at connections to appliances shall be Milwaukee BA-300, Nibco 595, or approved equal.

G. Valves shall be full size of pipe, NSF certified, manufactured by Nibco, Milwaukee, Apollo, or approved equal, in accordance with the following schedule and with the remainder of this specification section.

Ball Valves	3" and below	Nibco T-585HP-66-LF	Milwaukee UPBA-400S
Butterfly Valves	4" and above	Nibco LD-2022	Milwaukee HL-234E
Check Valves	2" and below	Nibco T-413-Y-LF	Milwaukee 508
	2-1/2" and above	Nibco F-910-B-LF	Milwaukee F-2970-M
Gas Valves	4" and below	Nibco T-FP-600A	Apollo 94ALF-A
	5" and above	Nordstrom 149	Resun R-1431-WGA

H. Ball Valves: All ball valves shall be two-piece bronze body with stainless steel ball and stem, PTFE packing/seats, and balancing handle. See the preceding table for acceptable manufacturers and models.

I. Motorized Ball Valves: Provide motorized ball valves where indicated on the drawings. Motorized ball valves shall be Belimo B2 or B3 Series, or approved equal with nickel plated brass body and stainless steel ball and stem.

J. Lockshield valves shall be lead-free ball type with locking lever, Nibco T-585-80-LF-LL, Crane D171LS, or approved equal.

K. Gate valves and their trim shall be selected for the specific service that they are associated with. Gate valves shall be Nibco T-113, Milwaukee UP-105, or approved equal.

L. Manual Balance Valves (2" and Below): Fixed port venturi style, IMI Flow Design AccuSetter UA Series, Pro Hydronic CBV Series, Taco Accu-Flo, Bell & Gossett Circuit Setter Plus, Nibco T-1810-LF, or approved equal. Variable orifice balancing valves are not acceptable.

M. Manual Balance Valves (2-1/2" and Above): Fixed port venturi style, IMI Flow Design AccuSetter AF Series, Hays Series CBVF, Nexus Series NVFB, Bell and Gossett Circuit Setter Plus, Nibco F739, or approved equal. Variable orifice balancing valves are not acceptable.

N. Automatic Pressure-Compensating Flow Control Valves: Valves shall include removable stainless steel cartridge, union, and test ports. Valves shall be Pro Hydronic Specialties Model AFLB (No Lead), IMI Flow Design Model ICSS (No Lead), Hays Mesurflo Model 2517 (No Lead), or approved equal. All ball valves shall have stainless steel ball and stem. All butterfly valves shall have stainless steel disc and stem.

O. Automatic Air Vent Valves: Automatic air vents shall be furnished as indicated on the drawings and shall be Hoffman No. 79, Spirotherm Spirotop, or approved equal. Pipe vents to the nearest floor sink. Valve pressure rating shall be as required for the associated system.

P. Manual Air Vent Valves: Manual air vents shall be furnished as indicated on the drawings, complete with ball type isolation valve, Hoffman Model 78, or approved equal. Valve pressure rating shall be as required for the system in which installed.

Q. Pressure Relief Valves

1. Provide ASME rated pressure relief valves and temperature and pressure relief valves as indicated on the drawings. Valve size and capacity shall be as required for proper relieving capacity equal to or greater than the capacity of the associated equipment output rating. Valves shall be sized and rated for compliance with Sections I, IV, and VIII of the ASME Boiler and Pressure Vessel Code, and ANSI Z21.22, as applicable.
2. Pressure Relief Valves: Where indicated on the drawings for boilers, heat exchangers, chillers, etc. provide bronze body relief valves with test lever, complying with listing requirements for temperature and pressure discharge capacity. Relief valves shall be Watts Series 174A, Series 374, Series 740, or approved equal.
3. Combination Temperature and Pressure Relief Valves: When indicated on the drawings for water heaters and/or hot water storage tanks provide bronze body relief valves with test lever and thermal sensor (thermostat), complying with the applicable listing requirements for temperature and pressure discharge capacity. Temperature and pressure valves shall be Watts XL Series, or approved equal.
4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering relief valves which may be incorporated in the Work include the following:

   Watts
   Bell and Gossett
   Spirax Sarco

R. General Purpose Solenoid Valves: General purpose solenoid valves for air or water shall be Asco Series 8210, or approved equal.

S. Tempering Valves: Provide tempering valves where shown and scheduled on the drawings. Install per manufacturer's written recommendations. Tempering valves shall be Lawler Series 61, or approved equal, with bronze finish, thermometer, and dual tempered water isolation valves.

2.3 VALVE TAGS

A. Tag each valve and provide a complete listing of valve locations and functions. Valve and tag listing shall be laminated and turned over to the Owner for posting as desired. In addition, where valves are located above a ceiling or behind an access panel, provide an adhesive clear plastic label with black 3/8" lettering on ceiling grid or access panel identifying the valve.

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

A. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

B. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane.

C. Provide a union at each connection to equipment, and at each threaded valve.

D. Install an isolation valve at the inlet of each equipment item, at each plumbing fixture, and elsewhere as indicated on the drawings.

E. Install a drain valve at each equipment item, located to completely drain the equipment for service or repair. Install at the base of each riser, at the base of each rise or drop in piping systems as required to completely drain each potable water system, and elsewhere as indicated on the drawings.

F. Install check valves with a minimum of 5 pipe diameters downstream of each pump discharge or change in direction (to avoid excessive turbulence at the check valve).

G. After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace the packing to stop leaks, and replace the valve if leakage persists.

3.2 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. At completion, carefully clean and adjust all equipment and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.3 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.4 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 05 20 - OPERATION AND MAINTENANCE OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Furnish the Architect/Engineer with two complete sets of typewritten operating and maintenance instructions, descriptive literature, catalog cuts, and diagrams covering all items of operation and maintenance for each and every plumbing system and piece of equipment furnished under these specifications.

B. In addition to the bound hard copies the Contractor shall provide an electronic copy (pdf file).

C. The Contractor shall commence compiling the above data (including obtaining operating and maintenance instruction data, catalog cuts, and diagrams from the manufacturer of the reviewed equipment) immediately upon review of his list of materials, so as not to delay the final installation and acceptance of the work.

D. Bind and index each set in a durable, hardboard binder. Final observation should not be requested until the operating and maintenance binders are submitted and have been reviewed by the Architect/Engineer.

E. Incorporate complete operating instructions including starting, stopping, and description of emergency manual operation methods for the following:

Plumbing Systems

Piping Systems

Temperature Controls

Test Data and Startup Reports

F. Provide charts and diagrams as required.

G. Provide operating manual for all equipment listed in individual sections of the specification.

H. Provide maintenance instructions for each item of individual equipment covering pertinent maintenance data, such as lubricants to be used, frequency of lubrication, inspections required, adjustments required, etc.

I. Provide parts bulletins containing manufacturer's part numbers, instructions, etc. for each item of equipment. Strip bulletins so that useless bulk is avoided.

J. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect/Engineer.

END OF SECTION

SECTION 22 05 30 - HANGERS AND SUPPORTS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing), 220500 (Basic Materials and Methods for Plumbing Systems), and Section 220540 (Seismic Bracing for Plumbing Systems) are hereby made a part of this section.

1.2 GENERAL

A. The following information is for pipe hanger and support layout and design reference only. The actual design of all hangers, supports, and seismic bracing is the responsibility of the Contractor per the following specification sections:

Specification Section 22 05 30 (Hangers and Supports for Plumbing Systems)
Specification Section 22 05 40 (Seismic Bracing for Plumbing Systems)

B. Piping: Hangers and supports for piping shall be designed in accordance with the latest adopted edition of the standards and codes listed below, and with any other applicable standards. Except in cases where a pipe stress analysis is performed to justify adjusted support and restraint spacing, pipe hangers and supports shall not be placed at intervals that are further apart than the requirements listed in UPC Table 313.3 and in UMC Table 313.3.

Steel Piping	Maximum Spacing	Reference
1-1/4” and smaller	7 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/2”	9 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2”	10 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2-1/2”	11 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3”	12 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3-1/2”	13 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
4”	14 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
5”	16 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
6”	17 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
8”	19 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
10”	22 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
12”	23 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
14”	25 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
Copper Piping	**Maximum Spacing**	**Reference**
3/4” and smaller	5 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1”	6 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/4”	7 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/2”	8 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2”	8 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2-1/2”	9 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3”	10 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3-1/2”	11 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
4”	12 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
5”	13 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
6”	14 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
8”	16 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
Gas Piping	**Maximum Spacing**	**Reference**
1/2”	6 feet	International Fuel Gas Code
3/4” & 1”	8 feet	International Fuel Gas Code
1-1/4” and larger	10 feet	International Fuel Gas Code

1.3 SUMMARY

A. This section Includes:
   1. Metal pipe hangers and supports
   2. Thermal hanger shield inserts
   3. Fastener systems
   4. Pipe stands
   5. Equipment stands
   6. Equipment supports

B. Related Requirements: All hangers and support systems shall be designed, selected, and installed by the Contractor to comply with the requirements listed in Section 220540 (Seismic Bracing for Plumbing Piping and Equipment).

C. Costs for hanger, support, and seismic bracing systems complying with the requirements listed herein are the responsibility of the Contractor and shall be included in the Contractor's bid. No extra cost will be allowed for failure to include the associated costs in the Contractor's bid.

D. In no case shall hangers and/or supports for plumbing piping or equipment be attached to a metal roof deck, unless provisions or allowances are explicitly shown on the structural drawings.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer**.** Show fabrication and installation details and include calculations for the following (Include product data for all components):
   1. Trapeze Pipe Hangers
   2. Metal Framing (Strut) Systems
   3. Pipe Stands
   4. Equipment Supports

C. Provide comprehensive, all-inclusive, delegated design submittals for all listed items. Submittals shall comply with all performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Details for fabrication and assembly of trapeze hangers.
   2. Design calculations utilized for designing the trapeze hangers.

D. The work of this section shall be coordinated with the requirements for the Contractor furnished seismic design submittal for hangers and supports specified in Section 220540 (Seismic Bracing for Plumbing Piping and Equipment). Design and detailing of seismic bracing, hangers, and supports is the responsibility of the Contractor.

E. Submittals shall be fully coordinated with the structural drawings and shall include all applicable structural and seismic attachment details. Locations and the methods of attachment of hangers and supports to the main structural frame shall comply with the limitations specified in the structural drawings. Submittals shall include all support anchorage loads and vectors broken out by discrete load type. Each specific load shall be indicated in the submittals and the structural element that the support is attached to shall be clearly depicted/identified.

F. Shop drawing submittals will be reviewed by both the design mechanical engineer and the design structural engineer (structural engineer when applicable)

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, 'Structural Welding Code - Steel'.

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE Standard 7-16.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic restraint hangers and supports for piping and equipment.
4. Design of connections for hangers, supports, and bracing shall comply with the requirements indicated on the structural drawings

2.2 GENERAL MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory mixed and packaged, dry hydraulic cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, non-corrosive, and non-gaseous.
2. Design Mix: 5,000 psi, 28 day compressive strength.

2.3 PLUMBING EQUIPMENT HANGERS AND SUPPORTS

A. Provide delegated design as applicable for the specific equipment.

2.4 PLUMBING PIPE HANGERS AND SUPPORTS

A. Carbon Steel Pipe Hangers and Supports

1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized, hot dip galvanized, or electro-galvanized.
3. Non-Metallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support the bearing surface of the piping.
5. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

B. Stainless Steel Pipe Hangers and Supports
   1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   3. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

C. Copper Pipe and Tube Hangers
   1. Description: MSS SP-58, Types 1 through 58, copper plated steel, factory fabricated components.
   2. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

2.5 HANGER AND SUPPORT MATERIALS

A. Additional hanger and support requirements are listed in sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger shield inserts for insulated piping and tubing.

I. Horizontal Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes 1/2” thru 30” size.
   2. Yoke Type Pipe Clamps (MSS Type 2): For suspension of up to 1050°F, pipes 4” thru 24” size, requiring up to 4 inchesof insulation.
   3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes 3/4” thru 36” size, requiring clamp flexibility and up to 4 inchesof insulation.
   4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes 1/2” thru 24” size if little or no insulation is required.
   5. Pipe Hangers (MSS Type 5): For suspension of pipes 1/2” thru 4” size, to allow off-center closure for hanger installation before pipe erection.
   6. Adjustable Swivel Split or Solid Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes 3/4” thru 8” size.
   7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
   8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
   9. Adjustable, Swivel Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
   10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes 3/8” thru 8” size.

11. Extension Hinged or Two Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes 3/8” thru 3” size.
12. U-Bolts (MSS Type 24): For support of heavy pipes 1/2” thru 30” size.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes 4” thru 36” size, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes 4” thru 36” size, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion type support for pipes 2-1/2” thru 3” size, 6” size if vertical adjustment is required, with steel pipe base stanchion support and cast iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes 1” thru 3” size, from two rods if longitudinal movement caused by expansion and contraction may occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes 2-1/2” thru 24” size, from single rod if horizontal movement caused by expansion and contraction may occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2” thru 42” size if longitudinal movement caused by expansion and contraction may occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes 2” thru 24” size if small horizontal movement caused by expansion and contraction may occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes 2” thru 30” size if vertical and lateral adjustment during installation may be required in addition to expansion and contraction.

J. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers 3/4” thru 24” size.
   2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers 3/4” thru 24” size if longer ends are required for riser clamps.

K. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inchesfor heavy loads.
   2. Steel Clevises (MSS Type 14): For 120°F to 450°Fpiping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120°F to 450°Fpiping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lbs.
    b. Medium (MSS Type 32): 1,500 lbs.
    c. Heavy (MSS Type 33): 3,000 lbs.
13. Side Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary, to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load adjustment capability. These supports include the following types:
   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe hanger selections and applications that are not specified in piping system sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system sections.

Q. Use powder actuated fasteners and mechanical expansion anchors instead of building attachments where required in concrete construction.

2.6 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop or field fabricated pipe support assembly made from structural carbon steel shapes with MSS SP-58 carbon steel hanger rods, nuts, saddles, and U-bolts.

2.7 METAL FRAMING (STRUT) SYSTEMS

A. Metal Framing Manufacturers Association (MFMA) Metal Framing Systems
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      B-line
      Unistrut
      Flex-Strut
      G-Strut
      Miro Industries

   2. Description: Shop or field fabricated, pipe support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Standard: Comply with MFMA-4 factory fabricated components for field assembly.
   4. Channels: Continuous slotted carbon steel channel with in-turned lips.
   5. Channel Width: Selected for applicable load criteria.
   6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   7. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.
   8. Metallic Coating: Zinc dichromate finish applied over an electro-galvanized zinc plating.

2.8 THERMAL HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

   Pipe Shields
   nVent/Caddy
   Buckaroos

B. Insulation Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100 psior ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psiminimum compressive strength and vapor barrier.

C. Insulation Insert Material for Hot Piping: Water repellent treated, ASTM C533, Type I calcium silicate with 100 psiASTM C552, Type II cellular glass with 100 psior ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psiminimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inchesbeyond sheet metal shield for piping operating below ambient air temperature.

G. Structural insert material for hot piping shall be water resistant, high density, calcium silicate with minimum a density of 28 lbs/ft^3 and a minimum compressive strength of 900 psi. Structural inserts shall be used as recommended by the manufacturer to meet load ratings.

H. Structural insert material for cold piping shall be water resistant, high density, polyisocyanurate with a minimum density of 14 lbs/ft^3 and a minimum compressive strength of 900 psi. Structural inserts shall be used as recommended by manufacturer to meet load ratings.

I. Provide a vapor barrier steel jacket around insulation. Insulation jackets shall be galvanized steel conforming to ASTM A653. Hanger bearing surface shall consist of a galvanized sheet metal insulation protection shield or casing.

J. Thermal hanger supports shall be load rated. Load ratings shall be established by the pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes and standards: ASME B31.1, MSS SP-68, MSS SP-69, and MSS SP-89.

K. Unless otherwise indicated, thermal hanger supports shall be as indicated in the following schedule, or approved equal. The listed model numbers are based on Pipe Shields.
   1. Pipe supported on hangers: Models A2000, A4000, A9000, and D3000 series.
   2. Pipe supported on flat surfaces: Models A2000, A4000, A6000, A7000, A7200, and A7400.
   3. Pipe Supported on pipe rolls: Models A4000, A6000, A8200, and A8400.
   4. Pipe supported on slides and guides: Model B series.
   5. Riser pipe supports: Model E series.

L. The selected model(s) shall conform to pipe service, support style, and support spacing.

M. Pipe support spacing shall be in accordance with the manufacturer’s recommendations, but in no case shall exceed the maximum spacing required by ASME B31.1.

2.9 FASTENER SYSTEMS

A. Powder Actuated Fasteners: Threaded steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Powder actuated fasteners may only be utilized for point loads of 50 lbs or less.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Hilti
      ITW Ramset/Red Head
      Simpson Strong-Tie

B. Mechanical Expansion Anchors: Insert wedge type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated stainless steel.
   2. Outdoor Applications: Stainless steel.
   3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Hilti
      ITW Ramset/Red Head
      B-line

2.10 PIPE STANDS

A. General Requirements for Pipe Stands: Shop or field fabricated assemblies made of manufactured corrosion resistant components to support roof mounted piping.

B. Compact Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Single base unit with integral rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
   3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   4. Hardware: Galvanized steel or polycarbonate.
   5. Accessories: Protection pads.

C. Low Profile, Single Base, Single Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
   3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   4. Vertical Members: Two galvanized steel, continuous thread 1/2 inchrods.
   5. Horizontal Member: Adjustable horizontal, galvanized steel pipe support channels.
   6. Pipe Supports: Roller strut clamps, clevis hanger, or swivel hanger.
   7. Hardware: Galvanized steel.
   8. Accessories: Protection pads.
   9. Height: 12 inchesabove the roof, or as indicated on the drawings.

D. High Profile, Multiple Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   3. Bases: Two or more vulcanized rubber molded polypropylene insert material.
   4. Vertical Members: Two or more galvanized steel channels.
   5. Horizontal Members: One or more, adjustable height, galvanized steel pipe supports.
   6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
   7. Hardware: Galvanized steel.
   8. Accessories: Protection pads**,** 1/2 inchcontinuous thread rod.
   9. Height: 24 inchesabove the roof or as indicated on the drawings.

E. Curb Mounted Type Pipe Stands: Shop or field fabricated pipe supports made from structural steel shapes, continuous thread rods, and rollers, for mounting on permanent stationary roof curb.

2.11 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment support made from structural carbon steel shapes.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with all requirements in other section of the specifications for firestopping materials and installation for penetrations through fire rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A36/A36M, carbon steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation
   1. Install powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inchesthick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.
   2. Install mechanical expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation
   1. Pipe Stand Types Except Curb Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate the roof membrane.
   2. Curb Mounted Type Pipe Stands: Assemble components or fabricate pipe stands and mounts on a permanent, stationary roof curb.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2” pipe size and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. 1/2” to 3-1/2” pipe: 12 incheslong and 0.048 inchthick.
      b. 4” and 5” pipe: 18 incheslong and 0.06 inchthick.
      c. 8” thru 14” pipe: 24 incheslong and 0.075 inchthick.
   5. Pipes 8”and Larger: Include wood or reinforced calcium silicate insulation inserts of length at least as long as protective shield.
   6. Thermal Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT HANGERS/SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor. Provide lateral bracing to prevent swaying for equipment supports.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing for equipment supports to prevent swaying.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780/A780M.

END OF SECTION

SECTION 22 05 40 - SEISMIC BRACING FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 220000 (Plumbing), Section 220500 (Basic Materials and Methods for Plumbing Systems), and Section 220530 (Hangers and Supports for Plumbing Systems) are hereby made a part of this section.

1.2 GENERAL

A. Seismic bracing for plumbing systems (equipment, piping, and conduit) shall comply with all applicable requirements of the latest adopted edition of the International Building Code (IBC) including all applicable provisions of the latest adopted edition of the American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures (ASCE Standard 7-16). Basic seismic design criteria for each project shall be as listed on the structural drawings for that project.

B. The anchorage calculations shall show compliance with the latest adopted edition of the American Concrete Institute (ACI) Standards, Handbooks, and Manuals where anchoring to concrete for the project-specific loads and conditions, including project specific calculations for anchors, clips, and fasteners.

C. Compliance with the applicable seismic bracing requirements for equipment, piping, and conduit shall be accomplished utilizing the most current version of one of the following design manuals, or approved equal.

International Seismic Application Technology (ISAT) Design Manual
Mason Industries Seismic Restraint Design Manual
Vibro-Acoustics Seismic Design Manual
SMACNA Seismic Restraint Manual (Guidelines for Mechanical Systems)

D. Component Importance Factors (Ip) for all equipment, ductwork, piping, and conduit shall be determined and assigned in accordance with ASCE Standard 7-16 Section 13.1.3.

E. Design and detailing of seismic bracing, hangers, and supports for equipment, piping, and conduit is the responsibility of the Contractor.

F. The work of this section shall be coordinated with the requirements for the Contractor furnished delegated design submittal for hangers and supports specified in Section 220530 (Hangers and Supports for Plumbing Systems). Design and detailing of seismic bracing, hangers, and supports is the responsibility of the Contractor.

G. Design of connections for hangers, supports, and bracing shall comply with the requirements indicated on the structural drawings (when provided).

1.3 SUBMITTALS

A. The Contractor shall provide the required number of seismic shop drawing submittal sets for review and approval by the Engineer. Submittals shall include a comprehensive set of shop drawings clearly depicting the seismic bracing requirements for all equipment, piping, and conduit. Any piping or conduit that does not require seismic bracing shall be specifically identified in the submittal, and the reason for exemption shall be provided. Cite any and all references for the exemption. In cases where seismic bracing is not required due to the supported items being less than 12 inches below the supporting structure, a single note may be provided to cover those locations.

B. Submittals shall be fully coordinated with the structural drawings and shall include all applicable structural attachment details. Seismic bracing shop drawings shall include all vertical support anchorage loads and all seismic bracing anchorage loads. Each specific load shall be indicated and the structural element that the support is attached to shall be clearly depicted/identified. Seismic bracing submittals shall be stamped and signed by a structural or civil engineer with current registration licensed in the State of Nevada (or licensed in the state where the project is located, if the project is located outside the State of Nevada).

C. Seismic shop drawing submittals will be reviewed by both the design mechanical engineer and the design structural engineer.

1.4 SITE VISITS (QUALITY CONTROL)

A. An authorized representative of the seismic bracing system manufacturer shall visit the job site during the construction period to confirm that the seismic bracing installation complies with the shop drawings, with all applicable code requirements, and with the seismic bracing system manufacturer's written installation requirements and associated details. As a minimum, an authorized representative shall visit the site when the seismic bracing installation is complete (and prior to installation of the ceilings).

B. A written report shall be issued within one week the site visit summarizing the observations made during the site visit and listing all required corrective actions and/or deficiencies. The report shall be made available to both the design mechanical engineer and the design structural engineer.

C. After all equipment installation is complete and all seismic bracing has been verified, the authorized representative that conducted the field verification shall issue a letter certifying that the installation is complete and that the installation complies with the specified requirements.

D. Site visits shall be coordinated with the Owner and shall be scheduled in writing a minimum of one week prior to the proposed site visit date.

END OF SECTION

SECTION 22 07 00 - INSULATION FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing insulation specified in this section include the following:

Domestic Cold Water Piping (Indoors)
Domestic Hot Water Supply and Return Piping
Rainwater Piping and Roof Drain Sumps
ADA Compliant Plumbing Fixtures
Removable Insulation Jackets
Equipment Insulation

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: A firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Install thermal insulation products on equipment in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

D. Flame/Smoke Ratings: For insulation installed inside the building provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with a flame spread rating of 25 or less and a smoke developed index of 50 or less, complying with ASTM E84.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-Value, thickness, density, and furnished accessories for each plumbing system requiring insulation. Include complete description of installation methods with this submittal.

PART 2 - PRODUCTS

2.1 PIPE INSULATION MATERIALS

A. All pipe insulation thicknesses and conductivities shall meet or exceed the requirements listed in International Energy Conservation Code Section C404.4 and in the Uniform Plumbing Code (whichever is more stringent). All conductivity values listed in this specification section are in Btu-in/(hr-ft^2-°F).

B. Kitchens, Hospitals, and Pharmacies: For insulated piping exposed in kitchen, hospital, and/or pharmacy areas the aluminum jacketing listed in the following sections shall be replaced with T-304 stainless steel jacketing.

C. Aluminum Jacketing shall be provided on exposed piping and shall be Johns Manville ‘JM Aluminum Jacketing’ with ‘Polyfilm Moisture Barrier’ and stucco-embossed finish, or approved equal, and shall be provided where indicated, in the following thicknesses:

1. For Insulation Outside Diameters under 8 inches: .016 inch thick jacketing
2. For Insulation Outside Diameters 8 inch and larger: .020 inch thick jacketing

D. Exposed in all piping applications shall mean any exposed pipe in a mechanical room or mezzanine area that is less than 8'-0" above finished floor.

E. Fiberglass Insulation

1. Fiberglass insulation shall be Johns Manville Microlok HP, or equal, with factory-applied fire-retardant ASJ jacket, self-sealing laps, and shall be applied per the manufacturer's written recommendations. Conductivity shall be .24 Btu-in/(hr-ft^2-°F) at 100°F.
2. Insulate and cover all fittings with Johns Manville Zeston Series 2000 pre-molded fitting covers secured with serrated tacks, adhesive, and/or Zeston Z-Tape.
3. Install a segment of rigid calcium silicate insulation at each pipe hanger for pipe sizes 2-1/2 inches and larger.
4. Finish all cold fittings with Zeston Z-tape to provide a vapor-tight seal.
5. Seal all raw ends and exposed fiberglass insulation with Childers CP-10 weather barrier sealant, or approved equal.
6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Johns Manville
   Knauf
   Owens Corning

2.2 DOMESTIC COLD WATER PIPING (INDOORS)

A. Insulate exposed domestic cold water piping with fiberglass insulation covered with aluminum jacketing and aluminum fitting covers.

B. Insulate concealed domestic cold water piping with fiberglass insulation. Do not insulate unions, valves, and exposed runouts to fixtures served with domestic cold water piping.

1. Minimum Insulation Thickness (All pipe sizes): 1 inch

2.3 DOMESTIC HOT WATER PIPING (INDOORS)

A. Insulate exposed domestic hot water supply and return piping with fiberglass insulation covered with aluminum jacketing and aluminum fitting covers.

B. Insulate concealed domestic hot water supply and return piping with fiberglass insulation. Do not insulate unions, valves, and exposed runouts to fixtures in domestic hot water piping.

1. Minimum Insulation Thickness:
   a. Piping 1 inch and smaller: 1 inch
   b. Piping 1-1/4 and 1-1/2 inch: 1-1/2 inch
   c. Piping 2 inch and larger: 2 inch

2.4 RAINWATER PIPING (INDOORS)

A. Insulate roof drain sumps with one layer of 1/2" thick self-adhesive closed cell elastomeric insulation (AP-ArmaFlex Self-Adhesive Insulation, or approved equal).

B. Insulate rainwater piping with fiberglass insulation, fitting covers, and Zeston Z-tape.

1. Minimum Insulation Thickness (All pipe sizes): 1 inch

2.5 OVERFLOW RAINWATER PIPING (INDOORS)

A. Insulation is not required on overflow roof drain piping located indoors.

2.6 ADA COMPLIANT PLUMBING FIXTURES

A. Insulate domestic hot water, domestic cold water, and waste piping below ADA compliant plumbing fixtures with Plumberex Pro-Extreme pipe covers, or approved equal. Covers shall be manufactured of 1/8 inch thick PVC with anti-microbial, anti-fungal, and UV-resistant properties. Covers shall have vandal resistant snap fasteners and shall comply with ASME A112.18.9.

2.7 EQUIPMENT INSULATION MATERIALS

A. General: All equipment insulation R-Values and thicknesses shall meet or exceed the requirements listed in International Energy Conservation Code Section C403.11.3.

B. Water Heating Equipment

1. Insulate all water heating equipment operating at increased surface temperatures and which does not have factory-applied insulation, including heating water system air separators. Do not insulate heating water expansion tanks or heating water pumps.
2. Flat insulation shall be 3 lb density fiberglass board with thickness as required for the operating temperature of the associated fluid inside the equipment. Insulation shall be Johns Manville Series 800 Spin-Glas with reinforced FSK jacket, Owens Corning Series 700 fiberglass board insulation with reinforced FSK jacket, or approved equal.
3. Curved insulation shall be 2.5 lb density semi-rigid fiberglass with thickness as required for the operating temperature of the associated fluid inside the equipment. Insulation shall be Johns Manville Micro-Flex large diameter pipe and tank insulation with reinforced FSK jacket, Owens Corning large diameter pipe and tank insulation with reinforced FSK jacket, or approved equal.
4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Johns Manville
   Knauf
   Owens Corning

C. Removable Insulating Jackets

1. Insulation and jacket material shall be rated for the operating temperature of the equipment and/or fluid being insulated. Insulating jackets shall be removable and reusable, thermal and acoustical insulating jackets, constructed of minimum 18 ounce material, and sewn with Kevlar thread.
2. Jackets for hot water applications shall be fabricated with PTFE-coated fiberglass fabric inner and outer material and minimum 1” thick needled fiberglass insulation (see pipe insulation section for required thickness based on pipe size and temperature).
3. Jackets for cold water applications shall be fabricated with PTFE-coated fiberglass fabric inner and outer material and 1” thick needled fiberglass insulation.
4. Insulating jackets shall be secured with stainless steel d-rings with straps and Velcro fasteners.
5. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Insultech
   MIT International
   Thermal Energy Products

6. Removable insulating jackets shall be provided for the following items.

   Motorized control valves located indoors and/or outdoors.
   Flanged valves located indoors and/or outdoors.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING INSULATION

A. The term ‘piping’ used herein shall include pipe, valves, strainers, and fittings. Apply insulating cements to fittings, valves, and strainers, and trowel smooth to the thickness of adjacent covering. Covering on valves shall extend up to the bonnet. The covering cement shall be of the types herein specified

B. Install insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

C. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.

D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full length units of insulation, with single-cut pieces to complete each run. Do not use cut pieces or scraps abutting each other.

E. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

F. Extend piping insulation without interruption through walls, floors, and similar penetrations, except where otherwise indicated.

G. Install pipe hangers on the outside of the insulation and not in contact with the pipe.

3.2 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective insulation. Leave entire work in condition satisfactory to Architect. At completion, carefully clean equipment installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.3 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 08 00 - TESTING, ADJUSTING, AND BALANCING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Temperature performance testing on all heat transfer equipment and/or components.

B. Test and balance of plumbing distribution systems and associated equipment and apparatus.

C. Testing, setting, and adjusting speed and volume of systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by the contract documents.

D. Component types of testing, adjusting, and balancing specified in this section includes the following as applied to plumbing equipment:

Plumbing Pumps
Balancing Valves for Plumbing Systems

1.3 QUALITY ASSURANCE

A. Balance Agency: Provide services and facilities of an independent agency that specializes in testing, analysis, and balancing of hydronic systems and air distribution for heating and cooling systems. Work shall be done by qualified engineering technicians and trained personnel, using instruments certified accurate to limits used in standard practice for testing and balancing of hydronic and air distribution for heating and cooling systems. The agency shall field test air and hydronic flows in accordance with methods prescribed by the Associated Air Balance Council, National Standard Volume 1, latest edition.

B. The balance agency shall be a member of the Associated Air Balance Council. Subject to compliance with requirements, the balance agency shall be one of the following:
RS Analysis
Raglen System Balance

C. The balance agency shall submit the results of tests in this section to the Architect/Engineer for review and acceptance.

D. AABC Compliance: Comply with AABC ‘National Standards’ Volume 1, as applicable to plumbing systems and associated equipment and apparatus.

E. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting and balancing, except as otherwise indicated.

F. Reference Standards:

1. AABC (Associated Air Balance Council) AABC National Standards Volume 1
2. ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers)

G. Test Instruments: Utilize test instruments and equipment for the test and balance work required, of type, precision, and capacity as recommended in AABC National Standards Volume 1.

1.4 SUBMITTALS

A. Provide a test and balance agenda that includes step-by-step testing and balancing procedures, test sheets, and schematic drawings, all being specific to the project.

B. Provide submittals to indicate the extent of work proposed. Submit certified test reports as hereinafter specified signed by test and balance technician/supervisor that performed test and balance work.

C. Include identification and types of instruments used and their most recent calibration date with submission of final test report.

D. The completed balance report shall be submitted for review and approval prior to requesting final observation of the project.

1.5 GENERAL REQUIREMENTS

A. The balance agency shall perform the following during the installation phase of systems:

1. Study design drawings and specifications and prepare a schedule to physically inspect plumbing equipment and devices to be tested and balanced. The Contractor shall provide the balance agency with one copy of the contract drawings and specifications, plumbing equipment submittals, and change orders necessary for proper balancing of plumbing systems.
2. The balance agency shall make field inspections prior to closing in portions of systems to be balanced. Agency shall verify to its satisfaction that all work, fittings, dampers, balancing devices, etc. are properly fabricated and installed as shown or specified and that Agency will be able to properly balance system.
3. Prepare a testing and balancing schedule, test record forms, and necessary technical information regarding the plumbing systems and equipment.
4. Provide written documentation when the above noted items have been completed. A single page letter signed off by the plumbing contractor and the test and balance agency will suffice.
5. Recommend adjustments and/or corrections to plumbing equipment and piping systems that are necessary for proper balancing of systems. Provide written documentation of the recommended items to the Architect/Engineer for review.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 BALANCING

A. All water systems and balance valves shall be balanced to within -5% to +5% of design.

B. Upon completion of plumbing systems, the test and balance agency shall complete tests, analysis, and balance of plumbing systems and equipment as appropriate.

C. This report shall include as minimum, but not be limited to (following design and actual information):

1. Motors and Pumps: Horsepower, brake horsepower, revolutions per minute, actual amperage, and full load rated amperage.
2. Pumps: Suction and discharge pressures.
3. Other information required to establish completely balanced systems.

END OF SECTION

SECTION 22 09 00 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing fixtures addressed in this section include the following:

Water Closets
Lavatories
Mop Sinks
Sinks
Water Coolers/Bottle Fillers

1.3 QUALITY ASSURANCE

A. All plumbing fixtures shall be certified under the United States EPA WaterSense program, as required by Nevada Assembly Bill AB163.

B. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this section:

American National Standards Institute
Federal Standards
California Plumbing Code (for projects located in California)

C. All plumbing components within the waterways shall comply with the following:

Safe Drinking Water Act
No Lead Restrictions of ANSI/NSF Standard 61 Section 9

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

B. Include confirmation/verification that all fixtures are certified under the United States EPA WaterSense program.

C. Operation and Maintenance Data: Submit operation and maintenance data and replacement material lists for each type of material listed in this section. Include this data and product data in the operation and maintenance manual.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle plumbing fixtures carefully to prevent breakage, chipping, and scoring the fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PLUMBING FIXTURES

A. Consult architectural drawings, as well as plumbing drawings for locations, dimensions, and mounting heights of plumbing fixtures.
   1. Take location and mounting heights for rough-in from architectural drawings.
   2. Follow schedule on plumbing drawings for rough-in connections. Set rough-in for all fixtures exactly per measurements furnished by the manufacturers of the fixtures used.
   3. Rough-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

B. All fixtures shall be first class in every respect. Accurately line up finished plumbing. Take special care with the rough-in and finished plumbing where batteries of fixtures occur.

C. Provide all water supplies to fixtures with compression shutoff stops with IPS inlets, threaded brass nipples at pipe connection, and a lock-shield loose key. Provide combination fixtures with a compression stop on each water supply fitting. Provide loose key handle for each stop. Provide 1/2 inch rigid risers for all fixtures unless otherwise noted.

D. Furnish shutoff valves on hose bibbs directly connected to mains with no intervening valves.

E. Except where otherwise specified, all finish for exposed metal trim on fixture shall be polished chromium plated. This also applies to wall flanges, nuts, and washers. Handles on all faucets and stops shall be all metal chromium plated.

F. Make connection between fixtures and flanges on soil pipe absolutely gas tight and water tight with neoprene type gaskets (wall hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.

G. Provide fixtures not having integral traps with P-traps of chromium plated cast brass body without cleanout connected to concealed waste in wall and sanitary fittings. Provide fixtures with a 17 gauge minimum traps and tailpiece and grid drain unless otherwise noted.

H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering traps which may be incorporated in the work include the following, or approved equal:

   McGuire Manufacturing
   Dearborn Brass

I. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets.

2.2 PLUMBING FIXTURE HANGERS AND SUPPORTS

A. Properly install and support plumbing fixtures as required and specified herein.

B. Carriers and supports shall be J.R. Smith, Zurn, Mifab, or approved equal, as recommended by the manufacturer for the particular installation and type of fixture being installed. Residential type fixture supports are not acceptable.

C. Install wall mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.

D. Install floor mounted water closets with J.R. Smith, Mifab, or approved equal cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps.

E. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.
   Water Coolers/Bottle Fillers

F. Install wall hung lavatories in stud walls with concealed arms and floor support, with feet of support securely anchored to the floor. In addition, anchor top of support to wall construction.

G. Support multiple faucet wash basins by welding 6” steel plates (minimum 1/8” thick) directly behind the 16 gauge wall studs. Drill pilot holes into the plates, an fasten the sink bracket to the plate using 3/8” self-tapping screws, and then use 6” flat strap for the other attachment locations.

2.3 PLUMBING FIXTURES

A. Fixtures shall be American Standard, Sloan, Kohler, Haws, Elkay, Bradley, Just, Acorn, or approved equal.

B. Fixture manufacturer and model shall be as scheduled on the drawings, complete with all components and accessories as illustrated and described. Provide stops for all concealed supplies.

C. Flush valves used at handicapped water closets shall be mounted on the wide side of the toilet enclosure.

D. All water coolers, drinking fountains, and hydration stations shall include integral water filters that are accessible from the front of the enclosure.

2.4 WATER CLOSET SEATS

A. Provide seats for standard elongated bowls with self-sustaining check hinges, stainless steel posts, white color.

2.5 CAULKING

A. For plumbing fixtures that require caulking, the caulking shall be installed in a neat and professional manner, in accordance with the manufacturer’s written instructions.

B. Caulking color (white or clear) shall be confirmed in writing with the Architect/Engineer prior to ordering or installing.

C. Caulking shall be Oatey Tub-N-Tile, or approved equal by GE or Dap.

D. Caulking for correctional facilities shall be Surebond SB-190 ‘pick-proof’, or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine rough-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors, substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install plumbing fixtures of types indicated where shown and at mounting height indicated on Architectural Drawings in accordance with fixture manufacturer's written instructions, rough-n drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the Uniform Plumbing Code pertaining to installation of plumbing fixtures.

B. In all cases where plumbing fixtures are mounted on or against building walls of concrete or other materials having relatively rough or non-planar surfaces, it shall be the responsibility of this Contractor to provide any necessary grout or backing materials required to facilitate fixture mounting and eliminate void spaces between fixtures and wall to ensure adequate bearing contact.

1. On completion of installation provide silicone sealer at all points of fixture contact with walls or floors.

C. Any fixture broken, cracked, or otherwise damaged during installation shall be replaced by the Contractor at no cost to the Owner.

3.3 TRAPPING AND VENTING OF FIXTURES

A. Trap and vent all plumbing fixtures in accordance with the Uniform Plumbing Code, whether or not shown on the drawings. Strictly adhere to any and all local codes. The only exceptions (which require specific written approval) will be those fixtures which are specially noted herein or on the drawings to be provided with special wastes.

B. No vent shall intersect another vent at a point less than 6 inches above the extreme overflow level of highest fixture served.

C. Take vents off the top half of horizontal runs and grade so as to free vents quickly of any water or condensation.

3.4 ADJUSTMENT OF PLUMBING PIPING SYSTEM

A. Test and adjust all flush valves so that each fixture receives the proper amount of water. Regulate all faucets, bibbs, drinking fountains, etc. to the approval of the Architect/Engineer so that the entire system is left in a first class condition.

B. Clean fixtures, equipment, and materials installed under this contract. Remove any/all cement, plaster, paint, rust, etc. Also remove any/all dirt, rubbish, paint spots, or grease on walls or fixtures for which this Contractor is responsible.

3.5 CLEANING AND PROTECTION

A. Clean plumbing fixtures of all dirt and debris upon completion of installation.

B. Protect installed fixtures from dirt and damage during the remainder of the project.

3.6 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. When feasible, restore and match finish to the original at site. Otherwise, remove the fixture and replace with a new unit. Feasibility and match to be judged by the Architect/Engineer. Remove any cracked or dented units and replace with new units.

3.7 OWNER TOOLS

A. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to the Owner with receipt. Furnish one device for every 10 units.

3.8 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.9 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.10 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 10 00 - FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing piping materials and components specified in this section include the following:
   1. Materials and Products
   2. Basic Pipes and Fittings
   3. Basic Valves
   4. Automatic Air Vents
   5. Manual Air Vents
   6. Exterior Hose Bibbs
   7. Point-of-Use Mixing Valves
   8. Water Hammer Arrestors
   9. Expansion Tanks for Potable Water
   10. Circulating Pumps for Potable Water
   11. Thrust Blocks

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing piping systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required for this project.

C. Plumbing Code Compliance: Comply with applicable portions of the Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

B. As-Built Drawings: At project closeout, submit as-built drawings of installed piping systems.

C. Operation and Maintenance Data: Submit operation and maintenance data and parts lists for plumbing piping systems materials and products. Include this data, product data, shop drawings, and record drawings in the operation and maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with the Uniform Plumbing Code. Where more than one type of material or product is indicated, selection is the Contractor's option.

2.2 BASIC PIPES AND PIPE FITTINGS

A. Copper Tube and Fittings
   1. Copper Tube: ASTM B88, hard drawn temper, except as otherwise indicated.
   2. Wrought Copper Solder Joint Fittings: ANSI B16.22.

B. Provide pipe and pipe fittings complying with Section 220500 (Basic Materials and Methods for Plumbing) and in accordance with the following listing:
   1. Interior Water Piping (and Exterior Water Piping Exposed Above Grade)
      a. Pipe 2 inches and Smaller: Copper tube; Type L, hard drawn temper; with wrought copper fittings and solder joints.
      b. Pipe 2-1/2 inches and Larger: Copper tube; Type L, hard drawn temper; with wrought copper fittings and brazed joints.
   2. Exterior Water Piping Below Grade
      a. Pipe 3 inches and Smaller: Copper tube; Type K, hard drawn temper; with wrought copper fittings and with brazed joints.
      b. Pipe 4 inches through 12 inch: Diamond Plastics 'Lok-21' AWWA C900 Polyvinyl Chloride (PVC) water pipe, Class 235, DR18, with restrained joints, or approved equal. Piping for potable water systems shall be certified under NSF Standard 61.
   3. Exterior Water Piping Below Building Slab and/or other Concrete Slab
      a. Pipe 2 inches and Smaller: Copper tube; Type K soft copper; with no fittings.
      b. Pipe 2-1/2 inches through 3 inches:
         1) Copper tube; Type L, hard drawn temper; with wrought copper fittings and brazed joints.
         2) Polypropylene (PP-R) SDR 7.4 pipe, with socket-fusion, butt-fusion, fusion-outlet, or electro-fusion fittings and joints.
      c. Pipe 4 inches through 12 inches: Diamond Plastics 'Lok-21' AWWA C900 Polyvinyl Chloride (PVC) water pipe, Class 235, DR18, with restrained joints, or approved equal. Piping for potable water systems shall be certified under NSF Standard 61.
   4. Underground Piping Corrosion Protection
      a. All buried copper pipe and fittings shall be wrapped with polyethylene corrosion protection pipe wrap, labeled for the type of pipe and fittings that it covers. Pipe wrap shall be Christy's Polywrap, or approved equal.
   5. Reverse Osmosis Water Piping (Type I and Type II RO Water Applications)
      a. Type 316 stainless steel pipe and fittings.
      b. Polyvinylidene Fluoride (PVDF) 'Kynar' pipe and fittings complying with ASTM E84 for a 25/50 flame/smoke rating.

2.3 VALVES

A. Provide valves complying with Section 220510 (Valves for Plumbing Systems).

2.4 AUTOMATIC AIR VENTS

A. Automatic air vents shall be furnished as indicated on the drawings and shall be rated for 150 psi at 250°F, and shall be Hoffman No. 78, Spirotherm Spirotop, or approved equal. Pipe vents to the nearest floor sink. Valve pressure rating shall be as required for the system in which installed.

2.5 MANUAL AIR VENTS

A. Manual air vents shall be furnished as indicated on the drawings and shall be rated for 150 psi at 250°F, and shall be Hoffman No. 78, Spirotherm Spirotop, or approved equal.

2.6 EXTERIOR HOSE BIBBS

A. Non-Freeze Wall Hydrants: automatic draining wall hydrant with flush mounted wall box, tee handle key, hinged stainless steel cover, operating rod length to suit wall thickness, 3/4 inch inlet and hose outlet, and integral backflow preventer.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hydrants which may be incorporated in the work include the following, or approved equal:

Woodford
Zurn
Watts

2.7 POINT-OF-USE MIXING VALVES

A. Provide point-of-use mixing valves of type and size as noted on the drawings. Valves shall be thermostatic type, UL and ASSE 1070 certified, rated for a maximum pressure of 125 psi. Provide the valve manufacturer's exposed stainless steel lockable cabinet for each mixing valve.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering point-of-use mixing valves which may be incorporated in the work include the following, or approved equal:

Leonard
NIBCO
Cash Acme

2.8 ARRESTORS

A. Install a manufactured water hammer arrestor in all water branch lines at single fixtures. Water hammer arrestors shall be sized per Plumbing Drainage Institute Standard PDI WH-201 'Water Hammer Arrestors'.

B. Where multiple fixtures are located in a row or battery install single or multiple water hammer arrestors, as appropriate. Water hammer arrestors for multiple fixture installations shall be sized and located per PDI Standard WH-201 and the manufacturer's installation instructions.

C. Water hammer arrestors shall have either threaded or soldered connections.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering water hammer arrestors which may be incorporated in the work include the following, or approved equal:

Precision Plumbing Products SWA or SC Series
Sioux Chief 650 Series

2.9 EXPANSION TANKS FOR POTABLE WATER

A. Provide expansion tanks of size and capacity as listed on the drawings. Expansion tanks shall be replaceable bladder type. Shell and heads shall be of carbon steel welded construction and shall be ASME rated for 125 psi at 240°F. Provide full volume flexible butyl rubber bladder, bottom system connection, air charging fitting, drain connection, lifting eye and base ring for vertical mounting. Tanks shall be factory pre-charged as indicated on drawings. Wetted connections shall be stainless steel and bladder material shall be FDA approved.

B. Install a ball valve with lockshield at all expansion tanks.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering expansion tanks which may be incorporated in the work include the following, or approved equal:

Watts
Elbi
Taco

2.10 CIRCULATING PUMPS FOR POTABLE WATER

A. Provide in-line circulating pumps of type, size, and capacity as shown and/or scheduled on the drawings.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering expansion tanks which may be incorporated in the work include the following, or approved equal:

Taco
Bell & Gossett
Grundfos

2.11 THRUST BLOCKS

A. All buried piping with friction type joints (bell and spigot, Tyton, etc.) shall have adequate concrete thrust blocks installed at each horizontal and vertical change of direction, at each tee, and at dead ends. Anchor piping at the entrance to the building.

PART 3 - EXECUTION

3.1 INSTALLATION OF WATER PIPING

A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.

B. Domestic hot water piping shall be re-circulated immediately behind each lavatory or group of lavatories (within 1 foot of each faucet, to ensure hot water availability within a reasonable time at low flow faucets).

C. Provide manufactured water hammer arrestors in water branch lines at single and multiple fixtures.

1. Water hammer arrestors shall be located as close to the fixture as possible and in conjunction with the manufacturer’s installation instructions.
2. Where multiple fixtures are located in a row or battery a single or multiple water hammer arrestors, as required, may be used.
3. Multiple fixture installations shall have the arrestor sized and located per PDI Standard WH-201 and the manufacturer’s installation instructions.

D. Install piping on room side of building insulation.

E. Check final location of rubber rings within couplings on PVC water piping with gauge or as recommended by manufacturer. Make connections to valves with cast iron adapters connected to water pipe with cast iron couplings. Furnish and install anchors or thrust blocks.

F. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with any Work until all unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Specification Section 220500 (Basic Materials and Methods for Plumbing).

3.3 INSTALLATION OF VALVES

A. Install valves as indicated on the drawings and in the following locations:
   1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
   2. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere indicated or required to completely drain potable water system.

3.4 INSTALLATION OF AIR VENT VALVES

A. Automatic Air Vent Valves: Install automatic air vent valves at the top of each hydronic riser and elsewhere as indicated on the drawings. Install a shutoff valve between each riser and vent valve, pipe the outlet to a suitable plumbing drain or as indicated on the drawings.

B. Manual Air Vent Valves: Install manual air vent valves on each hydronic terminal at the highest point, and on each hydronic piping drop in the direction of flow for mains, branches, runouts, and elsewhere as indicated on the drawings.

3.5 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water runouts to fixtures of sizes indicated.

B. Mechanical Equipment Connections: Connect hot and cold water piping systems and gas piping systems to mechanical equipment as indicated, and provide a shutoff valve and union at each connection.

3.6 DOMESTIC WATER SYSTEM STERILIZATION

A. Close open ends of water piping each day to prevent contamination or foreign matter entering pipe during construction. Thoroughly flush out piping to remove any dirt or foreign matter.

B. After flushing of pipe systems, sterilize entire water systems from new point or points of connection before being turned over to Owner for use. Slowly fill system with water and add chlorine chemical agent to produce a minimum of 50 ppm of chlorine in the entering water.

C. Retain treated water in pipe for a minimum of 24 hours. Should chlorine residual at pipe extremities be less than 50 ppm at this time, piping shall be re-chlorinated. As an option, the water systems may be filled with a water and chlorine solution containing a minimum of 200 ppm of chlorine and allowed to stand for four hours.

D. After chlorination, flush lines of chlorinated water and refill from the domestic water supply. Continue flushing until residual chlorine is not greater than the chlorine residual in the flushing water at all pipe extremities. The procedure shall be repeated if it is shown by bacteriological examination made by an approved testing agency that contamination persists in the system.

E. Domestic water sterilization shall be performed in accordance with all requirements of the Nevada Division of Health, Water Supply Regulations (or equivalent authority on projects located in California). Approval of the State Health Division shall be obtained prior to placing the system in service.

F. Submit a written report to the State Health Division as required by State regulations. Provide a copy of the report to the Architect/Engineer prior to placing the system in service and prior to completion of project.

3.7 TESTING OF PIPING

A. Test piping in accordance with the following schedule. There shall be no loss in pressure and no visible leaks after a minimum duration of four hours at the test pressures indicated.

System Tested	Test Pressure	Test With
Hot and Cold Water Piping	150 psi at rough-in and 100 psi after equipment connection	Water

B. Testing equipment, materials, and labor shall be furnished by the Contractor.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to the extent required to overcome leakage. Chemicals, stop-leak compounds, mastics, or other temporary repair methods are not acceptable.

D. Drain test water from piping systems after all testing and repair work has been completed.

3.8 SPARE PARTS

A. Furnish to the Owner, with receipt, one valve key for each key operated hydrant, hose bibb, and faucet installed.

3.9 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion carefully clean and adjust all equipment, fixtures, and trim that is installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.10 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.11 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 10 15 - COPPER PIPING WITH PRESS FITTINGS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

B. Section 221000 (Facility Water Distribution Systems) is hereby made a part of this section.

1.2 REFERENCE STANDARDS

A. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings

B. ASTM B75 - Standard Specification for Seamless Copper Tube

C. ASTM B88 - Standard Specification for Seamless Copper Water Tube

D. ASTM F3226 - Standard Specification for Metallic Press-Connect Fittings for Piping & Tubing

E. IAPMO PS 117 - Press and Nail Connections

F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials

1.3 SEISMIC COMPLIANCE

A. All press fittings shall have seismic certification complying with IBC Section 1705.13.2/3. Certification shall be in accordance with the ICC Evaluation Service Seismic Certification (AC156), or approved equal.

1.4 QUALITY ASSURANCE

A. Installer Qualifications

1. Installers shall attend a manufacturer’s installation training class and be certified as having been trained and qualified to join piping with press-connect fittings. On-site training and credentialing by a manufacturer’s representative is acceptable.
2. Installers shall be qualified, trained, and certified in the installation of press-connect fittings.
3. Press-connect fittings shall be installed using proper tools, actuators, jaws, and rings as approved by the manufacturer.

1.5 WARRANTY

A. The warranty period for Viega ProPress fittings shall be 50 years from the date of installation, and shall cover any labor and material costs caused by failure of a properly installed fitting.

1.6 SUBMITTALS

A. Submittals shall include information indicating all press fittings, all press tools, and copies of the training certifications for all individuals that are planned to install press fittings on the project.

PART 2 - PRODUCTS

2.1 GENERAL

A. Copper piping with press fittings shall be utilized only when and where specifically identified on the drawings and shall be limited to a maximum pipe size of 2 inches.

2.2 VIEGA PROPRESS PIPE AND FITTINGS

A. Viega ProPress Copper and Cast Copper Alloy Press-Connect Fittings
   1. Viega Press-Connect Fittings are approved for use with copper tubing conforming to ASTM B88 or B75. See Specification Section 232100 (Hydronic Piping and Accessories) for acceptable pipe materials.
   2. Conform to ASME B16.51, ASTM F3226, IAPMO PS-117, NSF 61, and NSF 372. Copper alloy fittings shall be zero lead silicon bronze alloy C87710 (cast) or C88700 (machined). Bismuth bronze or yellow brass fittings are not acceptable.
   3. Sealing elements shall be uniform in size and thickness, and shall be free from manufactured deformities and/or indentations.
      a. Sealing elements for installations designed for water temperatures of 200°F and below shall have peroxide-cured EPDM elastomeric sealing elements rated for 300 psi and a temperature range rating of 0°F through 250°F.
   4. Press-Connect fittings shall have the 'Viega Smart Connect' feature integral to the fitting body to detect unpressed fittings during the testing process.
   5. Provide color coded markings on exterior of fitting for readily identifying/inspecting sealing element type.
   6. Approved Fitting Manufacturer: Viega (no exceptions).

B. Approved Tool Manufacturers for Installation of Press-Connect Fittings
   1. Viega, Milwaukee, and/or Rigid.

2.3 VIEGA PROPRESS VALVES

A. Viega ProPress ball valves, butterfly valves, and check valves are acceptable when shown on the drawings. All valves shall be appropriate for the system in which they are installed.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Join copper tube and press-connect fittings with tools recommended by the fitting manufacturer. The manufacturer's installation instructions shall be strictly adhered to.
   1. All connections shall bear full insertion marks on the tubing.
   2. Special attention shall be given to the required two step pressure test.
   3. Perform an initial 'Viega Smart Connect' test for unpressed fitting detection per the manufacturer's installation manual.
   4. The installer shall use an indelible marker to place their initials on the copper pipe immediately adjacent to each completed press fitting, prior to any insulation being installed.
   5. Training certificates for any individual installing press fittings shall be available on site for review by the Engineer and/or Owner.

3.2 TESTING OF PIPING

A. Test piping in accordance with the following schedule. There shall be no loss in pressure and no visible leaks after a minimum duration of four hours at the test pressures indicated.

TEST SCHEDULE

Systems Tested	
Cold Water Piping Hot Water Piping	
Test Pressure	**Test Medium**
150 psi at rough-in	Water

100 psi after equipment connection Water

B. Testing equipment, materials, and labor shall be furnished by the Contractor.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to the extent required to overcome leakage. Chemicals, stop-leak compounds, mastics, or other temporary repair methods are not acceptable.

D. Drain test water from piping systems after all testing and repair work has been completed.

3.3 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion carefully clean and adjust all equipment, fixtures, and trim that is installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.4 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.5 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing piping and accessories specified in this section include the following:
   1. Materials and Products
   2. Basic Pipes and Fittings
      a. Above Ground Building Drain Piping
      b. Below Ground Building Drain Piping
      c. Vent Piping
      d. Condensate Drain Piping
   3. Trap Seals
   4. Cleanouts
   5. Floor Drains and Floor Sinks
   6. Miscellaneous Drains
   7. Plaster Interceptors

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing piping system products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems similar to that required for this project.

C. Plumbing Code Compliance: Comply with applicable portions of the Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping system materials and products.

B. As-Built Drawings: At project closeout, submit as-built drawings of installed piping systems in accordance with all associated requirements.

C. Operation and Maintenance Data: Submit operation and maintenance data and parts lists for all plumbing piping system materials and products. Include this data in the operation and maintenance manual in accordance with all associated requirements.

D. Sump Pump Product Data: Submit manufacturer’s pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated. Pump efficiency as well as construction will be taken into consideration when assessing the submitted pump.

E. Sump Pump Operation and Maintenance Data: Submit operation and maintenance data and parts lists for each type of pump, control, and accessory, including trouble-shooting maintenance guide. Include this data, product data, and shop drawings in the operation and maintenance manual, in accordance with all associated requirements.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with the Uniform Plumbing Code. Where more than one type of material or product is indicated, selection is the Contractor's option.

2.2 BASIC PIPES AND PIPE FITTINGS

A. Above Ground Building Drain Piping

1. Hubless cast iron soil pipe and fittings complying with the latest edition of CISPI Standard 301 and ASTM A888. Pipe and fittings shall be marked with the trademark of the Cast Iron Soil Pipe Institute.
2. Standard No-Hub Couplings: Provide banded couplings with neoprene gasket and Type 304 stainless steel clamp, screw, and shield, all in conformance with ASTM C564 and CISPI 310. Coupling shall be Anaco-Husky Standard No-Hub Coupling, or approved equal. Number of bands shall be as follows:

   Pipe Sizes 1-1/2” thru 4”: 2 Bands
   Pipe Sizes 5” thru 10”: 4 Bands
3. Heavy Duty No-Hub Couplings: Provide banded couplings with neoprene gasket and Type 304 stainless steel clamp, screw, and shield, all in conformance with ASTM C564. Coupling shall be Anaco-Husky Model HD-2000 Heavy Duty No-Hub Coupling, or approved equal. Number of bands shall be as follows:

   Pipe Sizes 1-1/2” thru 4”: 4 Bands
   Pipe Sizes 5” thru 10”: 6 Bands
4. Heavy duty no-hub couplings shall be installed on all exposed piping in mechanical rooms and storage rooms.
5. Heavy duty no-hub couplings shall be installed on all piping located over sensitive areas including kitchens, dining rooms, pharmacies, and laboratories.
6. Heavy duty no-hub couplings shall be installed on all piping located over critical care areas including, but not limited to, operating rooms, level 3 imaging rooms, etc.

B. Below Ground Building Drain Piping

1. Hubless cast iron soil pipe and fittings, complying with the latest edition of CISPI Standards 301 and ASTM A888. Pipe and fittings shall be marked with the trademark of the Cast Iron Soil Pipe Institute.
2. Hubless pipe couplings below grade shall be installed with 4 stainless steel clamps (6 for sizes 5” and above), 0.15” thick Type 304 stainless steel corrugated shield, 3/8” stainless steel bolts and nuts, and neoprene gasket in conformance with the ASTM C564 and ASTM C1540 for heavy duty shielded couplings. Couplings shall be Husky Model SD-4000, Ideal Tridon Heavy Duty, or approved equal.
3. See Specification Section 220500 (Basic Materials and Methods) for excavation and backfill requirements.

C. Vent Piping

1. Vent piping shall be hubless cast iron soil pipe and fittings, same as is specified for above-ground and/or below-ground building drain piping. Provide test tees where required by the Uniform Plumbing Code.

D. Cooling Coil Condensate Drain Piping

1. Type L, hard copper tubing with wrought copper solder joint fittings and 95 percent tin, 5 percent antimony solder. Condensate drain piping 1” and smaller shall use 45 degree wyes and long radius fittings at all changes in direction. Condensate drain piping 1-1/4” and larger shall use DWV fittings.

2.3 TRAP SEALS (TRAP GUARDS)

A. Provide trap seals only where specifically indicated on the drawings. Trap seals shall be IAPMO and ASSE 1072 approved.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering trap seals which may be incorporated in the work include the following, or approved equal:

Provent Systems ProSet Trap Guard
Jay R Smith Quad Close Trap Seal
Zurn Z-Shield Barrier Trap Seal

2.4 CLEANOUTS

A. General: Cleanouts of the same diameter as the pipe shall be installed in all horizontal soil and waste lines where indicated, and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding. Provide the listed products by Zurn, Mifab, or approved equal.

B. Cleanouts shall have cast iron ferrules and bronze plugs.

C. Cleanouts extending to floor level shall be provided with membrane flange and clamping collar, bronze raised head plug, and nonslip scoriated top.

1. Cleanouts in cast iron soil or waste lines: Zurn Z-1440-BP.
2. Cleanouts in walls: Zurn Z-1446-BP with stainless steel access cover.
3. Cleanouts at exterior of building: Zurn Z-1440-BP.
   a. Provide a stainless steel cover and vandal-proof screws where cleanouts are located in a wall. Zurn Z-1446-A.
   b. Where located at grade, provide an 18x18x6 inch concrete pad and a Zurn Z-1474 heavy duty cover with a Z-1440-A cleanout.
4. Cleanouts in concrete floors: Zurn ZN-1400
5. Cleanouts in terrazzo floors: Zurn Z-1400-T
6. Cleanouts in carpeted floors: Zurn ZN-1400-T-CM
7. Cleanouts in vinyl tile floors: Zurn ZN-1400-TX

2.5 FLOOR DRAINS AND FLOOR SINKS

A. Provide floor drains of size and type as scheduled and shown on the drawings, including all listed options and/or features. Floor drains shall be 5 inch size unless scheduled otherwise on the drawings. Provide a vented P-trap with a 1/2” trap primer connection below each floor drain and floor sink.

B. Install all floor drains and floor sinks in accordance with the manufacturer's written instructions and in the locations indicated on the drawings.

C. In the case of a shower and/or an above grade 2-pour concrete floor with a waterproofing membrane provide an anchor flange with seepage holes and clamp collar.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering floor drains and floor sinks which may be incorporated in the work include the following, or approved equal:

Zurn

2.6 MISCELLANEOUS DRAINS

A. Provide drains of size and type as indicated on drawings, including options or features as specified herein. Install vented P-traps below each drain.

1. Fixed Air Gap Drain: Zurn Z-1025 with size as noted on drawings for the pipe connection.

2.7 PLASTER INTERCEPTORS

A. Furnish and install Zurn plaster interceptors with minimum capacity indicated on the drawings. Interceptor shall be cast iron with an acid resistant coating on the interior and exterior.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plaster interceptors which may be incorporated in the work include the following, or approved equal:

Zurn

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor.

3.2 INSTALLATION OF SANITARY DRAINAGE SYSTEMS

A. Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the drawings piping shall have invert elevations as shown and shall slope uniformly between the given elevations.

B. Run all drainage piping as straight as possible with long radius bends. Make all offsets at an angle of 45 degrees or less.

C. Locate piping runs, except as otherwise indicated on the drawings, vertically and horizontally (pitched to drain), and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations, or if not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.

D. Hold piping close to walls, overhead construction, columns, and other structural and/or permanent enclosure elements of the building. Limit clearance to 1/2 inch where furring is shown for enclosure or concealment of piping. Wherever possible in finished and occupied spaces, conceal piping from view by locating piping in column enclosures, in hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated on the drawings.

E. Conceal piping in finished portions of building above the floor line, except where otherwise shown or noted. Cutting of walls and floors shall be held to the minimum possible to attain a proper and functional installation.

F. Should structural difficulties or work of other trades prevent the running of pipes or the setting of equipment at the locations shown on the drawings, any necessary deviations determined by the Contractor, shall be submitted for review by the Architect/Engineer, and shall be installed without additional cost to the Owner.

G. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on the pipe and that there are no obstructions in the pipes and/or fittings.

H. Cap or plug openings in pipes and fittings immediately to prevent dirt entry until fixtures are installed and/or final connections are made.

I. Below grade hubless cast iron drainage piping shall be installed on smooth soil that does not contain rocks that could damage the piping and the area below fittings shall be hand-cleared to allow the pipe and fitting to be properly supported by the soil below.

J. Hubless Cast Iron Joints: Comply with the coupling manufacturer's assembly and installation instructions and with the latest edition of CISPI Standard 310-12.

K. PVC Joints: Comply with the coupling manufacturer's assembly and installation instructions and with the latest edition of ASTM D2321.

3.3 INSTALLATION OF CLEANOUTS

A. Cleanouts: Install in piping as indicated, at each change in direction of piping greater than 45 degrees, at maximum intervals of 50 feet for piping 4 inch and smaller, at maximum intervals of 100 feet for piping 5 inch and larger, and at the base of each conductor.

B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through waterproof membrane.

3.4 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

A. Set the top of each drain slightly below the floor to ensure drainage.

3.5 INSTALLATION OF SANITARY DRAINAGE VENT PIPING

A. Grade all vent piping such that it will free itself quickly of any water or condensation.

B. Where possible, join groups of vent risers together to allow one enlarged roof penetration.

3.6 TESTING OF PIPING

A. Test piping at completion of rough-in in accordance with the following schedule. There shall be no loss of water level or pressure and no visible leaks after the test duration listed below.

System Tested	Test Procedure	Test With
All Soil, Waste, Drain, & Vent Piping. Minimum height of standpipe shall be 10 feet above the piping being tested.	Fill with water to the top of the highest vent and allow to stand for a minimum of 4 hours without a loss of water.	Water

B. At the Contractor’s option, piping may be tested with air per UPC Section 712.3.

C. Testing equipment, materials, and labor shall be furnished by this Contractor.

D. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

E. Drain test water from piping systems after testing and repair work has been completed.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Section 220500 (Basic Materials and Methods for Plumbing).

3.8 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion carefully clean and adjust all equipment, fixtures, and trim that is installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.9 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.10 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 14 00 - FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing piping and accessories specified in this section include the following:

Building Storm Drain Piping
Cleanouts
Roof Drains
Roof Drain Terminations

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing piping systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required for project.

C. Plumbing Code Compliance: Comply with applicable portions of the Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

B. As-Built Drawings: At project closeout submit as-built drawings of the installed piping systems in accordance with all associated requirements.

C. Operation and Maintenance Data: Submit operation and maintenance data and parts lists for plumbing piping systems materials and products. Include this data and product data in the operation and maintenance manual, in accordance with all associated requirements.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, and capacities as indicated. Provide materials and products complying with the Uniform Plumbing Code. Where more than one type of material or product is indicated, selection is the Contractor's option.

2.2 BUILDING STORM DRAIN PIPE AND PIPE FITTINGS

A. Above Ground Building Drain Piping

1. Hubless cast iron soil pipe and fittings complying with the latest edition of CISPI Standard 301 and ASTM A888. Pipe and fittings shall be marked with the trademark of the Cast Iron Soil Pipe Institute.

2. Standard No-Hub Couplings: Provide banded couplings with neoprene gasket and Type 304 stainless steel clamp, screw, and shield, all in conformance with ASTM C564 and CISPI 310. Coupling shall be Anaco-Husky Standard No-Hub Coupling, or approved equal. Number of bands shall be as follows:

   Pipe Sizes 1-1/2" thru 4": 2 Bands
   Pipe Sizes 5" thru 10": 4 Bands

3. Heavy Duty No-Hub Couplings: Provide banded couplings with neoprene gasket and Type 304 stainless steel clamp, screw, and shield, all in conformance with ASTM C564. Coupling shall be Anaco-Husky Model HD-2000 Heavy Duty No-Hub Coupling, or approved equal. Number of bands shall be as follows:

   Pipe Sizes 1-1/2" thru 4": 4 Bands
   Pipe Sizes 5" thru 10": 6 Bands

4. Heavy duty no-hub couplings shall be installed on all exposed piping in mechanical rooms and storage rooms.
5. Heavy duty no-hub couplings shall be installed on all piping located over sensitive areas including kitchens, dining rooms, pharmacies, and laboratories.
6. Heavy duty no-hub couplings shall be installed on all piping located over critical care areas including, but not limited to, operating rooms, level 3 imaging rooms, etc.

B. Below Ground Building Drain Piping

1. Hubless cast iron soil pipe and fittings, complying with the latest edition of CISPI Standards 301 and 310, and ASTM A888. Pipe and fittings shall be marked with the trademark of the Cast Iron Soil Pipe Institute. Shield and clamp assembly shall consist of a 300 series stainless steel corrugated shield, stainless steel bands (number of bands as required for pipe size) and sealing sleeve in conformance with ASTM C564.
2. Hubless pipe couplings below grade shall be installed with 4 stainless steel clamps, stainless steel bolts, stainless steel nuts, and neoprene gasket in conformance with CISPI Standard 310 and ASTM C1540 for heavy duty shielded couplings. Couplings shall be Husky Model SD-4000, Ideal Tridon Heavy Duty, or approved equal.
3. See Specification Section 3.2 for pipe bedding and backfill requirements.

2.3 CLEANOUTS

A. General: Cleanouts of same diameter as pipe shall be installed in all horizontal rainwater leaders where indicated and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding.

B. Cleanouts shall have cast iron ferrules and bronze plugs.

1. Cleanouts in cast iron drain lines: Zurn Z-1440BP
2. Cleanouts in walls: Zurn Z-1446-A with stainless steel access cover

2.4 ROOF DRAINS

A. Provide roof drains and overflow roof drains of size and type as indicated on the drawings, including options or features as specified herein. Locate roof drains per architectural roof plans. All roof drain domes shall be cast iron.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering floor drains and floor sinks which may be incorporated in the work include the following, or approved equal:

Zurn

2.5 ROOF DRAIN TERMINATIONS

A. Provide downspout nozzles of size and type as indicated on the drawings.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering floor drains and floor sinks which may be incorporated in the work include the following, or approved equal:

Zurn

PART 3 - EXECUTION

3.1 INSPECTION

A. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16 inch misalignment tolerance.

3.2 INSTALLATION OF DRAINAGE SYSTEMS

A. Run all horizontal storm drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the drawings piping shall have invert elevations as shown and shall slope uniformly between the given elevations.

B. Run all drainage piping as straight as possible with long radius bends. Make all offsets at an angle of 45 degrees or less.

C. Locate piping runs, except as otherwise indicated on the drawings, vertically and horizontally (pitched to drain), and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations, or if not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.

D. Hold piping close to walls, overhead construction, columns, and other structural and/or permanent enclosure elements of the building. Limit clearance to 1/2 inch where furring is shown for enclosure or concealment of piping. Wherever possible in finished and occupied spaces, conceal piping from view by locating piping in column enclosures, in hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated on the drawings.

E. Conceal piping in finished portions of building above the floor line, except where otherwise shown or noted. Cutting of walls and floors shall be held to the minimum possible to attain a proper and functional installation.

F. Should structural difficulties or work of other trades prevent the running of pipes or the setting of equipment at the locations shown on the drawings, any necessary deviations determined by the Contractor, shall be submitted for review by the Architect/Engineer, and shall be be installed without additional cost to the Owner.

G. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on the pipe and that there are no obstructions in the pipes and/or fittings.

H. Cap or plug openings in pipes and fittings immediately to prevent dirt entry until fixtures are installed and/or final connections are made.

I. Below grade hubless cast iron drainage piping shall be installed on smooth soil that does not contain rocks that could damage the piping and the area below fittings shall be hand-cleared to allow the pipe and fitting to be properly supported by the soil below. Bedding on sides and top of hubless drainage piping shall be clean crushed gravel (1/2” minus) or sand that is compacted to 85% proctor density.

J. Hubless Cast Iron Joints: Comply with the coupling manufacturer's assembly and installation instructions and with the latest edition of CISPI Standard 310-12.

K. Below grade PVC drainage piping shall be installed using clean, firm, and uniform bedding material. Provide a minimum of 4 inches of bedding below piping, a minimum of 8 inches on the sides, and a minimum of 6 inches above the piping, compacted to 85% proctor density.

L. PVC Joints: Comply with the coupling manufacturer's assembly and installation instructions and with the latest edition of ASTM D2321.

3.3 INSTALLATION OF CLEANOUTS

A. Cleanouts: Install in piping as indicated, at each change in direction of piping greater than 45 degrees, at minimum intervals of 50 feet for piping 4 inch and smaller, and 100 feet for piping 5 inch and larger, and at the base of each conductor.

B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through a waterproof membrane.

3.4 TESTING OF PIPING

A. Test piping at completion of rough-in in accordance with the following schedule. There shall be no loss of water level or pressure and no visible leaks after the test duration listed below.

System Tested	Test Procedure	Test With
All Storm Drain & Vent Piping within the Building. Minimum height of the standpipe shall be 10 feet above the piping being tested.	Fill with water to the top of the highest roof drain or vent and allow to stand for a minimum of 4 hours without a loss of water.	Water

B. At the Contractor’s option, piping may be tested with air per UPC Section 712.3.

C. Testing equipment, materials, and labor shall be furnished by this Contractor.

D. Repair any piping system sections that fail the required piping test, by disassembly and reinstallation, using new materials to the extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

E. Drain test water from piping systems after the testing and repair work has been completed.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Section 220500 (Basic Materials and Methods for Plumbing).

3.6 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave the entire work in a condition satisfactory to Architect/Engineer. At completion, carefully clean and adjust equipment that is installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.7 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 34 20 - ELECTRIC WATER HEATERS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing equipment specified in this section include the following:

Electric Water Heaters

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of plumbing equipment of type and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Grade or quality of materials desired is indicated by trade names or catalog numbers stated herein.

C. Dimensions, sizes, and capacities shown are minimum, and shall not be changed without permission of the Architect/Engineer.

D. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA Standards.

E. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's plumbing equipment specifications, installation and start-up instructions, capacity and ratings, with selection points clearly indicated.

B. Operation and Maintenance Data: Submit operation and maintenance data and parts lists for each item of plumbing equipment. Include trouble-shooting maintenance guide.

PART 2 - MATERIALS

2.1 TANK TYPE ELECTRIC WATER HEATERS

A. Electric water heater shall be completely insulated and jacketed for vertical installation. The jacket shall be a round heavy gauge galvanized steel assembly, primed and pre-painted on both sides with a minimum dry film thickness of 0.70 mils. Jacket shall have a full length element access panel and a hinged control panel access door for safety. The jacketed tank assembly shall have an accessible drain. The tank shall be factory insulated with a 3 inch thick high density non-CFC polyurethane foam to meet the minimum standby loss requirements of the latest edition of ASHRAE 90.1 (Energy Efficiency Standards).

B. The immersion heating elements shall be low watt density with an incoloy sheath for long life. The heating elements shall mount in individual screw-in tank flanges.

C. The tank shall be rated for 150 psi working pressure and a 300 psi test pressure. The tank shall be glass lined with vitreous glass enamel and fired at 1600°F to ensure molecular fusing of glass and steel. Tank saver anodes shall be installed in the tank for corrosion protection. A hand-hole cleanout shall be provided to allow inspection and cleaning of the vessel.

D. All field electrical wiring connections to the water heater shall be made to a main terminal block. All internal wiring shall be made to solderless terminal lug wiring connections. Wiring shall be color coded for ease of servicing. An ASME rated temperature and pressure relief valve shall be provided with the water heater. The water heater shall be factory assembled, wired, and tested. The entire water heater shall be UL listed and provided with a 3 year limited warranty on the tank and a 1 year limited warranty on parts.

E. Heating elements shall be switched by a magnetic contactor operated by a fused 120 volt control circuit with advanced electronic control. The electronic control shall have an LCD readout which shall display operational and diagnostic information. Standard features shall include low water cutoff, element sensing, and night setback. The control shall be capable of supplying up to 180°F water. The control circuit shall use a built-in transformer to reduce the line voltage to 120 volts for operation of the control circuit components. The control circuit shall include a manual reset safety high limit control to prevent over-heating in the event of a component failure.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electric water heaters which may be incorporated in the work include the following, or approved equal:

Lochinvar
State
Bradford White

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRIC WATER HEATERS

A. Install heaters as indicated on the drawings, in accordance with the manufacturer's written installation instructions, and in compliance with applicable codes.

B. Furnish wiring diagram to the electrical installer.

C. Connect hot and cold water piping to units with shutoff valves and dielectric unions. Connect drain and relief piping as noted on the drawings.

D. Start-up, test, and adjust water heaters in accordance with the manufacturer's start-up instructions. Check and calibrate controls.

E. All water heaters shall be secured in place with two straps as required by Uniform Plumbing Code Section 507.2.

F. All water heaters shall be installed with an aluminum drainage pan that is a minimum of 1 inch wider than the water heater on all sides. Drainage pans shall be minimum 2-1/2 inches deep and shall include a 1” pvc drain fitting. Drainage pans shall be Oatey aluminum water heater pans, or approved equal.

3.2 TRAINING

A. Provide a minimum of 1 hour of training and orientation of the Owner’s staff in proper care and operation of the electric water heaters and controls.

3.3 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to the Architect/Engineer. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.4 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.5 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this section.

B. This section lists general requirements for Heating, Ventilating, and Air Conditioning (HVAC) work and is hereby made a part of each Division 23 specification section.

C. For convenience or reference the Specifications are separated into Divisions and Sections. Such separations shall not operate to make the Engineer an arbitrator to establish subcontract limits between the Prime Contractor and his Subcontractors. In any case, the Prime Contractor is responsible to the owner for a complete job.

D. Wherever the word ‘provide’ is utilized with regard to materials or equipment on the drawings or in the specifications it shall be interpreted to mean ‘furnish and install’.

E. The term ‘exposed’ shall be interpreted to mean any equipment, ductwork, or piping that is not concealed above a continuous ceiling or inside a finished wall.

1.2 WORK INCLUDED

A. This section consists of general requirements and standard specifications covering certain parts of the HVAC work and is supplemented by other Division 23 specification sections covering additional work, requirements, and materials specifically applicable to the HVAC work of each section. Requirements of subsequent sections of the specifications, if in conflict with these general requirements, shall govern.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Provide work and materials in full accordance with the latest rules and regulations of the following:

Nevada

2024 International Building Code
2024 International Existing Building Code (when applicable)
2024 Uniform Mechanical Code
2024 Uniform Plumbing Code
2024 International Energy Conservation Code
2023 National Electrical Code
2024 International Fire Code
2024 NFPA Codes and Standards
Nevada State Fire Marshal
Nevada Occupational Safety and Health
National Fire Protection Association
Underwriters Laboratories
All other applicable state codes, rules, and regulations

B. Nothing in the drawings or specifications shall be construed to permit work not conforming to the listed codes and regulations.

C. In the event of an inconsistency between or within the plans, specifications, any of the contract documents, codes, or regulations, the better quality, higher cost, and/or greater quantity of materials and work shall be provided at no additional cost to the Owner.

1.4 FEES, PERMITS, AND UTILITY SERVICES

A. Obtain and pay for all permits and service required for installation of this work; arrange for required inspections and secure approvals from the authorities having jurisdiction.

B. Arrange for utility connections and coordinate work with utility company.

C. Arrange required inspections and secure approvals from the authorities having jurisdiction.

1.5 SITE EXAMINATION

A. Examine site, verify dimensions and locations against drawings, and inform self of conditions under which work is to be done before submitting proposal. No allowance will be made for extra expense on account of error.

B. Information shown relative to existing services is based upon available records and data but is approximate only. Make minor deviations found necessary to conform to actual locations and conditions without extra cost. Verify location and elevation of all utilities prior to commencement of excavation for new piping or its installation.

C. Exercise extreme care in excavating near existing utilities to avoid any damage thereto. This Contractor is responsible for any damage caused by his operations.

1.6 PLACEMENT OF EQUIPMENT AND WORK

A. The placement of equipment and mechanical work in the locations and spaces shown on the drawings is the Contractor’s responsibility.

B. Move equipment and/or work into spaces through openings provided or located in the spaces during construction, as required.

C. Perform disassembling and reassembling of equipment and/or other work necessary to accomplish this requirement without extra cost to the Owner.

1.7 SUBMITTALS AND SUBSTITUTIONS

A. In all cases, there is one basis of design manufacturer or product for each item of equipment or product shown on the drawings and/or specified herein. These products are identified by name and model number on the drawings and/or in the specifications. Alternative manufacturers and products are also listed; however, their inclusion as an alternative manufacturer or product does not cause them to be the basis of design. If an alternative manufacturer and/or product is desired to be used by the Contractor, it will be considered a substitution. Substitutions will be interpreted to be all manufacturers or products other than the basis of design. Only one request for substitution will be considered for each item of material or equipment. No substitutions will be considered thereafter. After a substitution request is reviewed and is found to be unacceptable the Architect/Engineer reserves the right to require the originally specified equipment or product at no additional cost to the Owner.

B. If the Contractor desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified. No substitutions will be allowed unless requested and reviewed in writing. The Architect/Engineer will review and take appropriate action on shop drawings, product data, samples, and other submittals as required by the contract documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the contract documents.

C. The review of submittals will not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Architect/Engineer shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the Contractor, nor shall the Architect/Engineer be required to review partial submissions or those for which submissions for correlated items have not been received. The Architect/Engineer reserves the right to require the originally specified item.

D. Installation of reviewed substitutions is the Contractor's responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the Owner. Review by the Architect/Engineer of the substituted equipment and/or the dimensioned drawings does not waive the requirements stated herein.

E. In any case where the Contractor intends to utilize a listed or unlisted acceptable equipment manufacturer that is not the basis of design as listed on the drawings and in the specifications it is the Contractor's responsibility to confirm prior to bidding that all ductwork, piping, controls, electrical power, conduit, service clearances, space requirements, and structural requirements match those of the basis of design equipment. Costs for any revisions necessary to accommodate the ductwork, piping, controls, electrical power, conduit, service clearances, space requirements, and structural requirements for the alternative equipment are the responsibility of the Contractor and shall be included in the Contractor's bid. No extra cost will be allowed for failure to allow for accommodations related to the alternative equipment in the Contractor's bid.

F. Submit to the Architect/Engineer for review, within a reasonable time after award of Contract and in ample time to avoid delay of construction, shop drawings or submittals on all items of equipment and materials, including all substitutions. Also see Division 1 for additional related requirements.

G. Partial or incomplete sets of equipment and materials submittals will not be acceptable.

H. Assessment of quantities is solely the Contractor's responsibility and will not be reviewed.

I. All submittal data shall be tailored to suit the specific project, with appropriate model or part numbers, materials, sizes, options, and accessories clearly indicated for each different submittal item and on each submittal page. Submittal pages without this information will be returned and will need to be resubmitted with all of the required information indicated on each sheet.

J. The Contractor shall certify that he has examined all submittal data and that the equipment and materials submitted for review meet or exceed the requirements of the drawings and specifications. Submittals without the required certification will not be acceptable.

K. Should the Contractor neglect to include submittal data for any item of equipment or material it shall be assumed and agreed that the associated equipment or material is the exact item specified as the basis of design on the drawings and in the specifications.

L. Items indicated by the Architect/Engineer to be resubmitted shall be resubmitted as follows:
   1. Retain items marked as 'No Exceptions Taken' or 'Make Corrections Noted' and resubmit with the revised package. Do not provide new sheets for these items.
   2. Provide revised submittal sheets for all other reviewed items. Provide originally submitted sheet with Architect/Engineer comments. Clearly indicate amendments and modifications made in response to previous submittal review comments.

M. Electronic Formatted Submittals
   1. Provide submittals in electronic form (.pdf file format).
   2. Identify and incorporate submitted information, including a cover sheet, and the following:
      a. Project Name
      b. Submittal Package Number (with revision number identified)
      c. Date
      d. Name of Architect/Engineer
      e. Name of Contractor
      f. Name of Subcontractor
   3. Group submitted items by specification section, and provide the following:
      a. Index of submitted products with page numbers
      b. Name of Firm or entity that prepared submittal
      c. Name of Supplier
      d. Name of Manufacturer
      e. Equipment and/or fixture tag, if applicable
      f. Number and title of appropriate specification section
   4. Items indicated by the Architect/Engineer to be resubmitted shall be resubmitted as follows:
      a. Retain items marked as ‘No Exceptions Taken’ or ‘Make Corrections Noted’ and resubmit with the revised package. Do not provide new sheets for these items.
      b. Provide revised submittal sheets for all other reviewed items.
      c. Provide originally submitted sheet with Architect/Engineer comments.
      d. Clearly indicate amendments and modifications made in response to previous submittal review comments.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Mention herein or on the drawings requires that this Contractor provide each item listed of the quality noted, or equal. All material shall be new, full weight, standard in all respects, and in first class condition. Provide materials of the same brand or manufacturer throughout for each class of material or equipment wherever possible. Materials shall be tested within the continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements.

B. The grade or quality of materials desired is indicated by the trade names and/or catalog numbers stated on the drawings and in the specifications.

C. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without the written permission of the Architect/Engineer.

D. All equipment shall comply with the mandatory equipment efficiencies listed in International Energy Conservation Code Section C403.3.2.

E. No material installed as part of this work shall contain asbestos in any form.

2.2 MATERIALS FURNISHED

A. Identify all materials and equipment by the manufacturer’s name and model number. Remove any unidentified materials and equipment from the site.

B. Equipment scheduled and/or specified by the manufacturer's model number shall include all accessories, controls, etc. listed in the catalog as standard with the equipment. Furnish optional or additional accessories as scheduled and/or specified.

C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged, and shall be replaced with new equipment. Variance from this requirement will be permitted only with the written consent of the Architect/Engineer.

D. Provide an authorized representative to constantly supervise the work of this division. Check all materials prior to installation for conformance with drawings and specifications.

PART 3 - EXECUTION

3.1 ACCESS TO HVAC WORK

A. Comply with manufacturer's written instructions for installation of access doors.

B. Access panels shall be furnished and installed wherever valves, balance valves, damper operating mechanisms, air terminal boxes, fans, and similar items normally requiring adjustment or servicing are installed in concealed or inaccessible spaces. Coordinate with access doors shown on architectural drawings.

C. Continuously check architectural drawings for clearance and accessibility of equipment specified herein to be placed. No allowance of any kind will be made for negligence on part of the Contractor to foresee means of installing his equipment into proper position.

3.2 DRAWINGS AND COORDINATION

A. General arrangement and location of piping, ductwork, equipment, etc. are shown on the drawings or herein specified. Carefully examine other work that may conflict with this work. Install this work in harmony with other crafts and at proper time to avoid delay of work.

B. In advance of construction, work out minor changes and relocations to suit actual conditions and work of other trades to avoid any conflicts. This shall not be cause for additional cost.

C. Verify all measurements at the building and be responsible for the correctness of same. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the drawings.

D. In addition, obtain all necessary information from the other trades regarding centers of partitions, walls, location of plumbing mains, fire sprinkler mains, and electrical conduits, ducts, pipes, etc. in order that pipes, equipment, and ductwork may be placed in their correct positions.

E. Execute all work shown on the drawings and not mentioned in the specifications, or vice versa, the same as if specifically mentioned by both. Omission from drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve the Contractor of furnishing and installing same in a complete and operational condition.

F. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and operational system.

G. Furnish materials and work at proper time to avoid delay of the work.

3.3 AS-BUILT DRAWINGS

A. Upon completion of work submit to the Architect/Engineer as-built drawings showing all changes in equipment, piping, ductwork, etc. installed as part of this project which are not in accordance with the contract drawings. As-built drawing deliverables shall be in accordance with the requirements of Division 1, and shall consist of the following as a minimum.

1. Provide as-built drawings in electronic file format (pdf file). In addition to the electronic file, when field mark-ups have been utilized, provide a complete set of full size neatly and legibly marked as-built drawings on 20 pound white bond paper.
2. As-built drawings shall be full size (same size as the contract documents) and shall be standard engineering scale. The minimum drawing scale shall match those provided in the contract documents.
3. As-built drawings shall include all outside utility connections, piping, etc. installed under this Contract. Locate and dimension all work with reference to permanent landmarks.

B. Match all symbols and designations used in the contract drawings when preparing the as-built drawings.

C. Indicate clearly and correctly all work installed differently from that shown, and maintain records up to date as work progresses. Include invert elevations of pipes below grade of floor, the floor lines, plugged wyes, tees, caps, exact locations and sizing of piping, location of valves, and the like. Dimension locations from structural points.

D. Properly identify all stubs for future connections as to locations and use by setting of concrete markers at finished grade in manner suitable to the Architect/Engineer.

3.4 PROJECT MODIFICATIONS

A. During the progress of construction, if any conditions arise that necessitate revisions, modifications, or relocation of any mechanical equipment or materials, such revisions shall be immediately brought to the attention of the Architect/Engineer. The Contractor shall then prepare necessary drawings showing the proposed changes. All proposed changes shall be submitted, reviewed, and approved by the Architect/Engineer prior to proceeding with any associated revision work in the field.

B. Maintain copies of all approved changes at the project site for reference by all parties during the remaining work.

C. Incorporate all revisions into the as-built drawings.

3.5 CLOSING IN OF UNINSPECTED WORK

A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected and tested. Should work be enclosed or covered up before it has been inspected and tested, uncover work at own expense. After it has been inspected and tested, make repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.6 FORMING, CUTTING, AND PATCHING

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this Contractor fails to coordinate with other contractors at proper time or fails to locate items properly, resulting in extra work, then this Contractor is responsible.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for work.

D. Cutting, patching, and repairing of existing (old) construction to permit installation of piping, etc. is responsibility of this Contractor. Repair or replace damage to existing work with skilled mechanics for each trade involved in a first class manner.

3.7 EXISTING SERVICES

A. Provide and install all required connections to existing systems as required by the drawings and specifications.

B. Integrate existing systems with all new work to provide a complete working system.

C. Provide minimum 48 hour notice to Owner of any service interruptions. All service interruptions shall be kept to the minimum possible time. When requested by Owner service interruptions shall occur outside of normal working hours.

D. The Contractor shall be responsible for damage to any part of the premises during the guarantee period that is caused by defects, leaks, or breaks in work furnished and/or installed under this section.

E. The Contractor shall replace refrigerant, lubricants, and/or gases lost as a result of defects, breaks, or leaks in the work.

3.8 PROJECT COMPLETION TESTS AND STARTUP

A. Upon completion of the mechanical work, or at such time prior to completion as may be determined by the Architect/Engineer, operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the building or project as a complete unit. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.

B. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. The Contractor shall notify the Architect/Engineer at least seven calendar days in advance of starting the tests listed herein.

C. Provide training and orientation of the Owner’s facilities staff in proper care and operation of equipment, systems, and controls.

D. Neatly tabulate and deliver to the Architect/Engineer complete operational data, including air flows, room temperatures, fan speeds, motor currents, plenum and duct static pressures, and other data as required. The Architect/Engineer reserves the right to spot check results, and if discrepancies or errors are noted, the Contractor will be required to redo balancing tests and tabulations entirely.

E. During the test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in a first class operating condition.

F. Mark final positions of balancing valves after balancing is complete.

G. All areas of the building shall receive proper flow of hot and chilled water to assure adequate and uniform temperatures throughout.

H. Final observation will not be conducted until all of the above requirements have been completed and the balance report has been submitted and reviewed.

3.9 TEMPORARY UTILITIES, HEATING, AND COOLING

A. Temporary utilities may be connected to the Owner's existing metered utilities only with the Owner's and the utility company's written authorization. Any connection to the Owner's existing utilities shall be separately metered to allow for proper allocation of utility costs unless another arrangement is specifically agreed to and authorized by the Owner in writing. Temporary meters shall be removed upon completion of the Work.

B. The Contractor shall be solely responsible for providing temporary heating, cooling, and/or ventilation as required to prevent degradation or damage to the Work. The permanent heating, cooling, and air handling systems shall not be utilized for the purpose of temporary heating, cooling, or ventilation until the Owner approves of such use in writing. In no case shall the permanent heating, cooling, or air handling systems be operated until they are complete, including formal startup, check out, and testing and balancing.

C. Utilization of any of the permanent heating, cooling, or air handling systems prior to the date of Substantial Completion shall not impact the specified warranty for such equipment, which shall begin on the date of Substantial Completion.

3.10 POST CONTRACT COMPLETION TESTS

A. If the required full load operation conditions cannot be conducted at the time of the 'Project Completion Tests and Startup' due to outdoor seasonal temperatures, the Contractor shall return to the job site when appropriate weather conditions arise (and/or when requested by the Architect/Engineer) to complete proper loading of equipment and systems as required. The Contractor will be allowed seven calendar days after notification to begin the tests. The Owner will be responsible for providing new air filters for the Contractor to install prior to this testing if necessary.

3.11 PRE-SEASON STARTUP

A. Within one year of filing of the Notice of Substantial Completion, when all full load tests required under 'Project Completion Tests and Startup' and 'Post Contract Completion Tests' have not yet been performed, the Contractor shall perform startup of any equipment or systems required for heating or cooling season operation when such equipment and systems have remained shut down or remain to be tested under full load. The Contractor shall ensure that all equipment and systems are operating properly before being turned over for the first operational use by the Owner. All such testing shall occur within one year of filing the Notice of Substantial Completion. The Owner will be responsible for providing new air filters for the Contractor to install prior to this testing if necessary.

3.12 WARRANTY/GUARANTEE

A. The Contractor shall be responsible for all work done and material installed under the plans and specifications. Repair or replace, as may be necessary, any defective work, material, or part which may show itself within one year of filing of the Notice of Substantial Completion and be responsible for damage to other materials, furnishing, equipment, or premises caused by such defects during this period, if in the opinion of the Architect/Engineer said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to the Owner.

3.13 ELEVEN MONTH O&M RE-TRAINING AND WARRANTY INSPECTION

A. Prior to the end of the one year warranty period (approximately 11 months after the date of the Certificate of Substantial Completion and prior to the one year warranty end date) the Contractor shall schedule a date with the Owner and the Engineer to conduct a thorough review of the mechanical systems and equipment, and provide follow-up operating and maintenance re-training (where requested by the Owner). All major Subcontractors associated with the mechanical work shall attend the operating and maintenance re-training and warranty inspection sessions. The Contractor shall video any follow-up operating and maintenance re-training that is requested by the Owner and provide electronic copies to the Owner and the Engineer. The Contractor shall take immediate action to remedy any warranty items identified during the warranty inspection, at no cost to the Owner. Provide a minimum of 14 days advance notice of the proposed date for the warranty inspection and operating and maintenance re-training sessions.

3.14 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 05 00 - BASIC MATERIALS AND METHODS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 230000 (Heating, Ventilating, and Air Conditioning) is hereby made a part of this section.

B. This section provides requirements for basic materials and methods related to all of the HVAC work. This section applies to all other Division 23 specification sections.

1.2 WORK INCLUDED

A. Types of HVAC items specified in this section include the following:

1. General Materials
2. Hangers and Supports for HVAC Systems
3. Seismic Bracing for HVAC Systems
4. Access Doors and Panels
5. Roof and Wall Flashings
6. Unions and Flanges
7. Cathodic Protection
8. Pipe Escutcheons
9. Penetrations in Fire and Smoke Rated Partitions and Floors
10. Piping and Equipment Identification
11. Painting
12. Concrete Work
13. Electric Motors
14. Electric Motor Starters
15. Electrical Disconnects
16. Pre-Fabricated Roof Curbs
17. Welding

1.3 PROJECT CONDITIONS

A. Existing Utilities: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of valves and piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Valve Types: Provide valves of same type by the same manufacturer.

C. Identification: Provide valves and piping specialties with the manufacturer's name or trademark and pressure rating clearly marked on the valve body.

1.5 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each type of manufactured valve and piping specialty. Include pressure drop curve or chart for each type and size of isolation valve, balancing valve, and control valve.

B. Operation and Maintenance Data: Submit operation and maintenance data and spare parts lists for each type of manufactured valve and piping specialty. Include this data and product data in the operating and maintenance manual in accordance with all associated requirements.

C. All interface requirements (BACnet or other) shall be coordinated with the temperature control system subcontractor prior to issuing submittals and/or ordering any equipment that is required to have an interface.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

A. Provide factory-fabricated valves and piping specialties as recommended by the manufacturer for use in the service indicated. Provide valves and piping specialties of types and with pressure ratings indicated for each service, or if not indicated, provide proper selections as determined by the Contractor to comply with the installation requirements. Provide sizes and connections which properly mate with pipe, tube, and equipment connections.

2.2 HANGERS AND SUPPORTS FOR HVAC SYSTEMS

A. See Specification Section 230530 (Hangers and Supports for HVAC Systems).

2.3 SEISMIC BRACING FOR HVAC SYSTEMS

A. See Specification Section 230540 (Seismic Bracing for HVAC Systems).

2.4 ACCESS DOORS AND PANELS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 22 inch by 22 inch minimum size in usable opening. Where entry of service personnel may be required, provide a 22 inch by 30 inch minimum usable opening.

B. Access doors shall match those listed in the architectural documents in all respects, except as noted herein.

C. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

D. Provide insulated access doors where located in internally insulated ducts or casings.

E. Where specific information or details relating to access panels different from the above is shown or given on the drawings or other divisions of work, then that information shall supersede this specification.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering access doors which may be incorporated in the work include Milcor, Best, or approved equal:

Milcor Style M	Drywall and/or Masonry
Milcor Style K	Plaster
Milcor Style UFR	Fire Rated (where required)

2.5 ROOF AND WALL FLASHINGS

A. Flashing for penetrations of the roof for mechanical items such as ducts, pipes, and flues shall be as indicated on the drawings and in these specifications. Where exterior sheet metal flashings are indicated on the drawings or details, the flashings shall be galvanized sheet metal. The work of this section shall include layout, sizing, and coordination of roof and wall penetrations with all trades. Flues shall have a 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.

2.6 UNIONS AND FLANGES

A. Furnish and install unions at each threaded connection to all equipment, tanks, etc. Unions shall be in accordance with the following listing:

Type of Pipe	Union

Steel pipe 2" and smaller	150 lb threaded malleable ground joint, brass to iron seat, black for black piping, galvanized for galvanized piping.
Steel pipe 2-1/2" and larger	125 lb cast iron threaded flanged union, flat faced, gasket, black for black piping, galvanized for galvanized piping.
Copper tubing 2" and smaller	150 lb bronze ground joint, bronze to bronze sweat connection.
Copper tubing 2-1/2" and larger	150 lb cast bronze, flat faced flange with silver brazing threadless ends.

B. Insulating couplings or flanges shall be furnished and installed at all connections of piping with dissimilar materials. Construct couplings so that the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Heavily line the couplings with a hard, insulating, phenolic threaded coupling in standard pipe sizes.

C. Furnish and install flanges at each flanged connection to equipment, tanks, and valves per the following schedule:

Type of Pipe	Flanges
Threaded black or galvanized steel pipe 2-1/2" and larger	125 lb threaded cast iron, flat face flange, black or galvanized steel as applicable.
Welded steel pipe 2-1/2" and larger	150 lb welded forged steel, raised face flange.

D. Provide full faced or ring type gasket material to suit facing on flanges. Gasket material shall be 1/16" thick Garlock Blue-Gard, or approved equal. Gasket material shall be suitable for the connected piping system content and temperature.

2.7 PIPE ESCUTCHEONS

A. Provide chrome plated brass pipe escutcheons with inside diameter closely fitting pipe outside diameter or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, ceilings, or pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish and screw or spring clamping device with concealed hinge.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe escutcheons which may be incorporated in the work include the following, or approved equal:

Chicago Specialty Manufacturing Company
Producers Specialty and Manufacturing Corporation
Sanitary Dash Manufacturing Company

2.8 PENETRATIONS IN FIRE AND SMOKE RATED PARTITIONS AND FLOORS

A. Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe, conduit, and duct penetrations. Seal all penetrations with fire-stop and smoke-stop materials complying with the requirements for firestopping and fill materials specified in this section.

B. Schedule and conduct a firestopping pre-installation conference at the job site. Coordinate all firestopping means and methods with other contractors and the general contractor (when applicable) prior to beginning any work.

C. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 (Approval of Firestop Contractors), or been evaluated by UL and found to comply with their ‘Qualified Firestop Contractor Program Requirements’.

D. Install all penetration firestopping systems to comply with the manufacturer's written installation instructions and published drawings for products and applications.

E. Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by the penetration firestopping system manufacturer or when substrates are wet because of rain, frost, condensation, or other causes.

F. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilation, or where this is inadequate, forced-air circulation.

G. The specified firestopping systems are based on a solid sealant only, or combinations of solid sealant, foam sealant, and refractory fibers of thickness required to attain hour ratings.

H. Fire and Smoke Partition Systems shall comply with the following:
   1. Provide a flexible seal to prevent passage of fire, smoke, toxic gases, and water through openings, and prevent transmission of sound and vibration from the penetrating element to the structure.
   2. Provide hour ratings indicated and in accordance with ASTM E814 and/or UL 1479.
   3. For projects located in the State of California comply with requirements of CBC Sections 709.6, 709.7, 709.8, 710.2, 710.3 and 710.6, and CBC Standards 7-1 and 7-5.

I. Acceptable Manufacturers: 3M, Hilti, SpecSeal, Nelson, HoldRite, Tremco, Roxtec, or approved equal. The established standard in most cases is 3M, unless otherwise specified. The listed products are specified to establish standards and the type of materials required. Materials shall be as specified, or approved equal.

J. Sealant: Select among the following materials as appropriate.
   1. Solid (Elastomeric): 3M Fire Barrier Premium Latex CP 25WB+ Caulk, one-component elastomeric water-based latex sealant designed for use as a through-penetration firestop
   2. Foam: 3M Fire Barrier 2001 Silicone RTV Foam, two-component silicone elastomer foam-in-place sealant designed to fill irregular or complex voids.
   3. Wrap Strip: 3M Fire Barrier FS-195+ Wrap Strip, fire resistive strip designed to be wrapped around the penetrating item and secured in place.
   4. Restricting Collar: 3M Fire Barrier RC-1 Restricting Collar, sheet metal, designed for use with wrap strip in combustible through-wall firestop penetration systems.
   5. Composite Sheet: 3M Fire Barrier CS-195+ Composite Sheet, elastomeric layer reinforced with mesh restraining wire and covered with aluminum foil on one side and bonded to sheet metal, forming a fire resistive sheet.
   6. Putty: 3M Fire Barrier MP Moldable Putty+ Pads and Sticks, one-component elastomeric formable putty, designed for use as a through-penetration firestop system.
   7. Spray: 3M FireDam Spray 100, flexible water-based coating.
   8. Primers: As recommended by the sealant manufacturer.

K. Pillows: Nelson PLW Firestop Pillow, Hilti FS Fire Block, dust proof chemical resistant cloth with heat-reactive expanding solidifying fill, designed for large openings that require frequent cable alterations.

L. Safing Insulation: USG Thermafiber Safing Insulation, 4 lb density mineral wool insulation, unless indicated otherwise.

M. Damming Materials: As recommended by the firestopping manufacturer.

2.9 PIPING AND EQUIPMENT IDENTIFICATION

A. Each piping system furnished and installed under this work shall be identified and the direction of flow indicated by means of colored labels and flow arrows, all as specified herein. The labels shall be applied after all painting, priming, and cleaning of the piping and insulation is completed.

B. Provide prefabricated coiled plastic piping labels as manufactured by Marking Services Incorporated (MSI), or approved equal. Labels shall comply with the most current edition of ANSI/ASME Standard A13.1 with regard to color, letter height, and marker size. The labels shall have black or white lettering and flow arrows on colored backgrounds and shall not require adhesive. The background colors shall conform to the color schedule included in the 'Execution' section of this specification.

1. For pipe labels used indoors use coiled polyester labels, MSI Model MS-975, or equal.
2. For pipe labels used outdoors use coiled polyester labels, MSI Model MS-995, or equal.
3. For piping with an outside diameter, including insulation, greater than 6 inches provide the label manufacturer's nylon straps to secure label to piping. Labels shall lie smoothly against pipe or insulation completely around the pipe.
4. The size of the lettering and label shall be such that the lettering can be easily read from the floor and the colors shall be easily discernible.

C. Provide a white plastic lamacoid plate for each and every piece of equipment installed in this work. Lettering on plate shall be black, with size of lettering to suit equipment. Lettering shall be a minimum of 1/2 inch in height. Plates shall be riveted or bolted to equipment near electrical disconnect or control access panel.

D. Where mechanical or plumbing equipment requiring access is located above a ceiling or behind an access panel, provide an adhesive clear plastic label with 3/8" black lettering on the ceiling grid or access panel identifying the equipment.

E. Ground loop circuit piping inside a mechanical room shall be labeled to coincide with the numbering indicated on the mechanical drawings.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following, or approved equal:

Marking Services Incorporated (MSI)
LEM Products
Seton
Craftmark

2.10 PAINTING

A. In general, painting will be done by others. Exposed piping and unfinished portions of equipment to be painted shall be cleaned by this Contractor of grease, oil, rust, or dirt in preparation for painting. Spot prime all factory primed surfaces as necessary.

2.11 CONCRETE WORK

A. Where specifically indicated on the drawings or specified as part of the mechanical work, this Contractor shall furnish and install concrete work such as thrust blocks and/or spring isolator bases.

B. Concrete and reinforcing steel shall be equal to that specified for general construction.

C. Except as noted above, concrete work will be furnished and installed by others. This Contractor shall coordinate all requirements accordingly.

2.12 ELECTRIC MOTORS

A. Electric motors larger than 1/2 horsepower rating, unless otherwise noted, shall be ball bearing, open drip proof, squirrel cage, induction type, normal starting torque, 3 phase, 60 cycle service, 40°C continuous rating, and shall conform in all respects to latest applicable standards of NEMA and AIEE. Motors shall be Century, Louis Allis, Baldor, or equal. Motors located outdoors shall be TEFC type.

B. All motors 1 horsepower and above shall be premium efficiency type, Century E-Plus, or approved equal.

C. Motors utilized with variable frequency drives shall be rated as inverter duty per NEMA standards.

D. Motors shall have nameplate voltage rating of operating voltage specified in subsequent sections of specifications or as shown on drawings and shall have a 1.15 service factor.

E. For normal applications, motors shall be furnished for normal starting torque duty. It shall be this Contractor's responsibility, however, to provide motors and starters (where starters are furnished under this section) having suitable starting torque and current characteristics to allow starting the equipment within the branch circuit protection provided and within the overload protection required by code.

F. Splash-proof or totally enclosed motors having a continuous duty temperature rise rating not exceeding 35°C shall have adequate starting torque, as recommended by the manufacturer, for the service intended.

G. All motors shall be rated at ±10% of the scheduled voltage. If not, provide each motor with a boost transformer sized for the intended use and installed in a rated enclosure.
   1. Boost transformers for equipment provided under the mechanical work shall be furnished by the mechanical contractor and turned over to the electrical contractor for installation, unless otherwise noted.

H. Shaft Grounding
   1. All variable frequency drive motors less than 300 horsepower shall have a single shaft grounding system to protect the bearings from capacitive discharge through the bearings.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following, or approved equal:

      CR Series by Shaft Grounding Systems
      AEGIS SGR Conductive Microfiber Brush

2.13 ELECTRIC MOTOR STARTERS

A. Magnetic motor starters for equipment provided under the mechanical work shall be furnished by the mechanical contractor and turned over to the electrical contractor for installation, unless otherwise noted. All motor starters shall be by the same manufacturer, Westinghouse, Square D, Cutler-Hammer, General Electric, or approved equal.

B. Magnetic motor starters provided as part of motor control centers shall be provided and installed by the electrical contractor.

C. Unless otherwise noted, magnetic motor starters shall be furnished in a NEMA 1 enclosure for inside installation and in a gasketed NEMA 4 enclosure for outside installation, with three thermal overloads for three phase motors and one overload element for single phase motors. All overloads shall be ambient compensated.

D. Submit schedule to the Architect/Engineer denoting the following:
   1. Designation of each motor
   2. Name plate rating of each motor
   3. Running current of each motor
   4. Catalog number and rating of starter overload elements
   5. Circuit breaker trip size (when in combination starter)

E. Combination magnetic starters shall be Westinghouse Type A206 with circuit breaker disconnect and trip size of breaker as required for motor size, or as otherwise noted.

F. Magnetic motor starters shall be Westinghouse Type A200, or approved equal.

G. Manual motor starters shall be Westinghouse Type MST01 less enclosure, or approved equal.

H. Magnetic motor starters shall be provided with cover-mounted Hand-Off-Auto 'Oil-Tight' type switches as scheduled, with integral fused 120 volt control transformer.

2.14 ELECTRICAL DISCONNECTS

A. The short circuit current rating (SSCR) of each integral or factory-furnished disconnect switch provided by Division 23 shall match or exceed the SSCR of the source panel or distribution board. Coordinate with Division 26 for the results of the Short Circuit Studies required in the Division 26 specifications prior to release of order(s) for disconnects. This requirement applies to all electrical disconnects, including but not limited to, disconnects for chillers, boilers, variable frequency drives, air handling units, rooftop units, condensing units, etc.

2.15 PRE-FABRICATED ROOF CURBS

A. Provide manufacturer's standard shop-fabricated units, modified if necessary, to comply with project requirements. All roof curbs shall be secured to the roof support structure.

B. All roof curbs shall be modified when necessary using pressure-treated tapered wood at the top of the support units to form a level top edge.

C. Roof curbs for equipment weighing over 400 lbs shall be seismically designed and rated, with seismic calculations prepared by a Nevada licensed structural engineer, based on an Importance Factor of 1.0, except for critical buildings or applications which require a higher Importance Factor based on the specific application.

D. The roof curb height listed on the drawings indicates the minimum height of the curb at the lower end of the roof slope. The Contractor is responsible for confirming the roof insulation assembly depth on the architectural drawings in order to determine the actual required height of each roof curb. All roof curbs shall be constructed such that the top of the curb is a minimum of 14 inches above the lowest point of the finished roof surface. For most applications the roof thickness is approximately 8 inches, resulting in a total curb height of 22 inches. Verify actual height with the architectural plans.

E. Fabricate structural framing for units of structural quality sheet steel formed to manufacturer's standard profiles for coordination with roofing, insulation, and deck construction. Include 45 degree cant strips and deck flanges with offsets to accommodate roof insulation. Weld corners and seams to form water-tight units.

F. Where roof curb metal gauge is not indicated fabricate units of 14 gauge metal.

G. Provide a pressure-treated wood nailer, not less than 1-5/8" thick and of not less than the width of the metal support wall assembly. Anchor nailer securely to top of metal frame unit.

H. Field-install rigid insulation inside the roof curb assembly on all four sides and on the bottom of the roof curb. Insulation shall have a minimum insulating valve of R-11.4. See mechanical equipment curb detail(s) on the drawings for additional information and requirements.

I. Available Manufacturers: Subject to compliance with requirements, manufacturers offering prefabricated seismic roof curbs which may be incorporated in the work include the following, or approved equal:

Same Manufacturer as Equipment
MicroMetl
Thybar

2.16 WELDING

A. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M (Structural Welding Code - Steel).

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code Section IX. Comply with ASME B31.9 (Building Services Piping) for materials, products, and installation.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Perform excavation required for installation of piping, service lines, and other work as indicated on the drawings. Verify location and elevation of all existing utilities prior to excavation for installation of new piping.

B. Excavations shall be of open vertical construction of sufficient width to provide free working space at both sides of the trench and around piping as required for joining, caulking, backfilling, and compacting.

C. Where invert elevations are not shown, dig trenches in accordance with the following:

Exterior Water Piping (36 inches minimum cover)
Gas Piping (18 inches minimum cover)

D. Dig trenches straight and true to line and grade with holes for bells for bell-and-spigot pipe. Evenly support piping for its entire length upon outside periphery of lower one third of pipe.

E. Where rock is encountered, undercut trenches by 3 inches, and fill with well tamped clean sand or pea gravel as required to correct pipe elevation.

F. After piping in the excavation has been installed and tested, backfill excavation to a point 6 inches above the piping using utility sand or pipe sand that is free of rocks and debris. Proceed evenly on both sides of the pipe and continuously tamp. Except as hereinafter noted, backfill more than 6 inches above the top of the pipe shall be made by using earth from the excavation placed in layers of 6 inch maximum depth. Compaction of each successive layer shall be achieved using a mechanical compactor. See drawings and trench details for additional requirements.

G. Special care shall be taken when backfilling over and around wrapped or pre-insulated piping to prevent damage to the protective wrapping and/or insulation.

H. Any backfill which subsides or settles below the adjacent finished grade or paving level during the guarantee period shall be brought to grade by the Contractor by adding compacted backfill or additional paving in paved areas.

I. See trench detail(s) on the drawings for additional information and requirements.

3.2 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole and is flush with adjoining surface.

B. Sleeves: Secure sleeves to metal or wood forms in such a manner that they will not become displaced during pouring of concrete. Fill sleeves on deck with sand. After forms have been removed from concrete, the sleeves shall be removed from the openings.

C. Core drill properly sized holes in the concrete to replace metal sleeves that are crushed or knocked out of position during pouring of concrete.

D. Provide piping passing through concrete fire walls with sleeves of standard black steel pipe nominally one size larger than pipe enclosed, but in the case of insulated pipe, large enough for insulation to pass through. Caulk space between pipe and sleeve with fire rated wicking, and provide metal retainer plates at both sides of the wall.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Section 230530 (Hangers and Supports for HVAC Systems).

B. Where special hanger/support of piping or ductwork is detailed or shown on the drawings, the drawings shall be followed.

3.4 INSTALLATION OF UNIONS AND FLANGES

A. Install unions and flanges so that piping can be easily disconnected for removal of tanks, equipment, and valves. Also see Specification Section 230510 (Valves for HVAC Systems).

3.5 INSTALLATION OF CATHODIC PROTECTION

A. Install dielectric unions in the following locations:

1. At points in piping where dissimilar metal pipes are connected together.
2. Any special applications shown on the drawings.

3.6 INSTALLATION OF PIPE IDENTIFICATION

A. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.

B. The legend and flow arrow shall be applied at all valve locations, at all points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction, and at approximately 20 foot intervals on pipe runs.

C. Practical variations or changes in locations and spacing may be made with the specific approval of the Architect/Engineer to meet specific conditions.

D. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.

E. Markings shall be located to be conspicuous from any reasonable vantage point.

F. The legends and flow arrows shall be in the colors as indicated in the pipe marking schedule.

G. Pipe labels shall be as described in Section 2.20 of this specification (Piping and Equipment Identification).

H. Pipe Marking Schedule (Based on ANSI/ASME Standard A13.1-2023)

Service	Color
Refrigerant Piping (ASHRAE Class A1)	White Text on Black Background
Refrigerant Piping (ASHRAE Class A2L)	Black Text on Yellow Background

I. Where different equipment such as fire sprinklers are supplied from a common main, such as a domestic water main, the main should be identified as ‘Domestic Water’ and each respective branch takeoff as ‘Fire Water’, etc.

J. Legacy Identification Schemes (Existing Facilities and Renovation Work): In existing facilities where the piping identification was previously labeled based on an earlier edition of ANSI/ASME Standard A13.1 (including the 1996 edition or the 2020 edition), the existing color scheme may be continued for renovation, alteration, and tenant improvement work, in accordance with the most current edition of ANSI/ASME Standard A13.1, provided that both of the following conditions are met:

1. The existing scheme is described in writing and made available to building operation and maintenance personnel, or affected employees are trained on the operation and hazards of the piping systems; and

2. The existing scheme is applied consistently throughout the affected systems within the facility. Where new piping systems are introduced into an existing facility under this work, the new piping shall be labeled in accordance with the existing facility scheme to maintain consistency, and the Contractor shall coordinate with the Owner to confirm the applicable scheme prior to ordering labels.

3.7 INSTALLATION OF AIR VENTS

A. Install air vents in hydronic systems at all high points and as required to adequately bleed all air from the piping systems and equipment during initial filling, normal operation, and subsequent filling of each piping system.

B. Install air vents in steam and condensate systems at all high points and as required to adequately bleed all air from the piping systems and equipment during initial filling, normal operation, and subsequent filling of each piping system. Air vents for steam systems shall be balanced pressure type, Spirax Sarco Model VS-204, or approved equal by Armstrong.

3.8 DEMOLITION WORK

A. Demolition work shall be performed only where specifically identified on the drawings. Unless specifically indicated otherwise, demolition work shall include removal of all associated equipment, electrical and controls components, conduit and wiring, piping, valves and accessories, and supports. The surfaces where the demolition work was performed shall be restored to match the adjacent surfaces to the best extent practical.

B. When demolition work involves leaving existing systems in place for a prolonged time period (more than 30 days and/or any time period when there is the potential for freezing temperatures) the Contractor shall protect all existing equipment, piping, and ductwork from potential damage during the time that the equipment, piping, and ductwork is out of service.

C. The protection procedures shall include draining all hydronic coils and the associated piping systems that may be susceptible to freezing temperatures when the building heating system is disabled.

D. The protection procedures apply to both hydronic piping and domestic water piping systems. After the piping systems are drained, the Contractor shall purge all water from the hydronic coils, hydronic piping systems, and domestic water piping systems using compressed air or other appropriate means, and shall seal any open ends such that the potential for corrosion is minimized. This work shall be performed by an experienced mechanical or plumbing contractor, rather than by a demolition contractor.

3.9 FORMING, CUTTING, AND PATCHING

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this Contractor fails to coordinate with other contractors at the proper time or fails to locate items properly, resulting in extra work, the Contractor is responsible for the additional work, at no cost to the Owner.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for all work.

D. Cutting, patching, and repairing of existing (prior) construction to permit installation of piping, conduit, etc. is the responsibility of the Contractor. Repair or replace any damage that occurs to existing work in a first class manner using skilled mechanics for each trade involved.

E. Cut existing construction in a neat and workmanlike manner by the use of a concrete saw. Use of pneumatic devices is not acceptable.

F. Core openings through existing construction as required for the passage of any new piping and/or conduit. Cut holes of the minimum diameter required to suit the size of the pipe to be installed, including the associated insulation.

G. In any case where it is necessary to disturb or remove structural fireproofing the Contractor shall be responsible for restoring the fireproofing to match the original condition. Fireproofing restoration shall be performed by a properly trained and licensed contractor.

3.10 ELECTRICAL WORK

A. Adequate working space shall be provided around electrical equipment in compliance with the National Electrical Code and other applicable codes. Mechanical work shall be coordinated with the electrical work in order to comply with these requirements. Any work which does not conform to these requirements shall be corrected without additional cost to the Owner.

B. Furnish and install all line and low voltage temperature control wiring in the mechanical work (typically furnished and installed by the temperature control subcontractor) including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Unless noted otherwise, this does not include primary control wiring between starters and pushbuttons, other manual starter switches, or branch power circuits required for the temperature control system.

C. Electrical Coordination
   1. Starters located in motor control centers will be provided under the electrical work. The Contractor is referred to electrical drawings for motors served by motor control centers.
   2. Motors furnished under the mechanical work shall be furnished by the mechanical contractor, but connection to power wiring shall be by the electrical contractor. Coordinate all motor starter requirements with the electrical contractor.
   3. Temperature control equipment, including relays shown on control diagram, shall be furnished and installed by the temperature control subcontractor.
   4. Electrical devices with piping connections, such as solenoid valves, insertion thermostats, strap-on aquastats, and similar items which are to be wired under the electrical work or by the temperature control subcontractor, shall be installed by the mechanical contractor.

D. Equipment furnished in this work that is factory wired but requires modification to internal wiring to meet specifications or drawing requirements shall have such internal modifications made at the factory before shipment.

E. All electrical work and equipment, including internal wiring, shall comply with applicable codes and applicable portions of the electrical specifications. Route line and low voltage control wiring in conduit. Conduit for temperature control wiring shall be the responsibility of the mechanical contractor and shall be of the type specified in Division 26.

3.11 POST-CONSTRUCTION OWNER TRAINING

A. In addition to the Owner training requirements listed in all other specification sections, the Contractor shall provide an overall comprehensive training session one month prior to the one year warranty expiration date. This session is intended to address any and all questions that the Owner’s facility staff may have with regard to operation and maintenance of all of the installed mechanical systems.

3.12 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.13 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.14 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 05 20 - OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Furnish the Architect/Engineer with two complete sets of typewritten operating and maintenance instructions, descriptive literature, catalog cuts, and diagrams covering all items of operation and maintenance for each and every mechanical system and piece of equipment furnished under these specifications.

B. In addition to the bound hard copies the Contractor shall provide an electronic copy (pdf file).

C. The Contractor shall begin compiling the above data (including obtaining operating and maintenance instruction data, catalog cuts, and diagrams from the manufacturer of the reviewed equipment) immediately upon review of his list of materials, so as not to delay the final installation and acceptance of the work.

D. Bind and index each set in a durable, hardboard binder. Final observation should not be requested until the operating and maintenance binders are submitted and have been reviewed by the Architect/Engineer.

E. Incorporate complete operating instructions including starting, stopping, and description of emergency manual operation methods for the following:

1. Heating Systems
2. Ventilating Systems
3. Air Conditioning Systems
4. Piping Systems
5. Temperature Control Diagrams
6. Test Data and Startup Reports

F. Provide charts and diagrams as required.

G. Provide operating manuals for all equipment listed in individual sections of the specification.

H. Provide maintenance instructions for each item of individual equipment covering pertinent maintenance data, such as lubricants to be used, frequency of lubrication, inspections required, adjustments required, etc.

I. The Contractor shall video the operating and maintenance instruction sessions for all major items of equipment. The separate videos shall be of reasonable content and quality.

J. Provide parts bulletins containing manufacturer's part numbers, instructions, etc. for each item of equipment. Strip bulletins so that useless bulk is avoided.

K. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect/Engineer or Owner.

END OF SECTION

SECTION 23 05 30 - HANGERS AND SUPPORTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 230000 (Heating, Ventilating, and Air Conditioning), Section 230500 (Basic Materials and Methods for HVAC Systems), and Section 230540 (Seismic Bracing for HVAC Systems) are hereby made a part of this section.

1.2 GENERAL

A. The following information is for pipe hanger and support layout and design reference only. The actual design of all hangers, supports, and seismic bracing is the responsibility of the Contractor per the following specification sections:

Specification Section 23 05 30 (Hangers and Supports for HVAC Systems)
Specification Section 23 05 40 (Seismic Bracing for HVAC Systems)

B. Piping: Hangers and supports for piping shall be designed in accordance with the latest adopted edition of the standards and codes listed below, and with any other applicable standards. Except in cases where a pipe stress analysis is performed to justify adjusted support and restraint spacing, pipe hangers and supports shall not be placed at intervals that are further apart than the requirements listed in UPC Table 313.3 and in UMC Table 313.3.

Steel Piping	Maximum Spacing	Reference
1-1/4” and smaller	7 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/2”	9 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2”	10 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2-1/2”	11 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3”	12 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3-1/2”	13 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
4”	14 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
5”	16 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
6”	17 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
8”	19 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
10”	22 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
12”	23 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
14”	25 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
Copper Piping	**Maximum Spacing**	**Reference**
3/4” and smaller	5 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1”	6 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/4”	7 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/2”	8 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2”	8 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2-1/2”	9 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3”	10 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3-1/2”	11 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
4”	12 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
5”	13 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
6”	14 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
8”	16 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
Gas Piping	**Maximum Spacing**	**Reference**
1/2”	6 feet	International Fuel Gas Code
3/4” & 1”	8 feet	International Fuel Gas Code
1-1/4” and larger	10 feet	International Fuel Gas Code

C. Ductwork: Hangers and supports for rectangular and round ductwork shall be designed in accordance with the latest adopted edition of the SMACNA HVAC Duct Construction Standards. Vertical duct supports shall also be designed in accordance with the latest adopted edition of the SMACNA HVAC Duct Construction Standards. Note that the SMACNA HVAC Duct Construction Standards require that duct hangers also be installed within 2 feet of duct elbows and within 4 feet of duct branch fittings.

D. Rectangular Ducts: Maximum spacing and strap and/or hanger rod sizes shall be in accordance with SMACNA HVAC Duct Construction Standards Table 4.1.

E. Round Ducts: Maximum spacing and strap and/or hanger rod sizes shall be in accordance with SMACNA HVAC Duct Construction Standards Table 4.2.

1.3 SUMMARY

A. This section includes the following:
   1. Metal Pipe Hangers and Supports
   2. Thermal Hanger Shield Inserts
   3. Fastener Systems
   4. Pipe Stands
   5. Ductwork Supports
   6. Equipment Stands
   7. Equipment Supports

B. Related Requirements: All hangers and support systems shall be designed, selected, and installed by the Contractor to comply with the requirements listed in Section 230540 (Seismic Bracing for HVAC Systems).

C. Costs for hanger, support, and seismic bracing systems complying with the requirements listed herein are the responsibility of the Contractor and shall be included in the Contractor's bid. No extra cost will be allowed for failure to include the associated costs in the Contractor's bid.

D. In no case shall hangers and/or supports for HVAC piping, ductwork, or equipment be attached to a metal roof deck, unless provisions or allowances are explicitly shown on the structural drawings.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for the following (Include product data for all components):
   1. Metal Framing (Strut) Systems
   2. Trapeze Pipe Hangers
   3. Pipe Stands
   4. Ductwork Supports
   5. Equipment Supports

C. Delegated Design Submittals: Provide comprehensive, all-inclusive, delegated design submittals for all listed items. Submittals shall comply with all performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Details for fabrication and assembly of trapeze hangers.
   2. Design calculations utilized for designing the trapeze hangers.
   3. Design details and calculations for ductwork and equipment supports.

D. The work of this section shall be coordinated with the requirements for the Contractor furnished seismic design submittal for hangers and supports specified in Section 230540 (Seismic Bracing for HVAC Systems). Design and detailing of seismic bracing, hangers, and supports is the responsibility of the Contractor.

E. Submittals shall be fully coordinated with the structural drawings and shall include all applicable structural and seismic attachment details. Locations and the methods of attachment of hangers and supports to the main structural frame shall comply with the limitations specified in the structural drawings.

F. Submittals shall include all support anchorage loads and vectors broken out by discrete load type. Each specific load shall be indicated in the submittals and the structural element that the support is attached to shall be clearly depicted/identified.

G. Shop drawing submittals will be reviewed by both the design mechanical engineer and the design structural engineer (structural engineer when applicable).

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M (Structural Welding Code - Steel).

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Where required, engage a licensed professional engineer (licensed in the state where the project is located), to design trapeze pipe hangers/supports, ductwork hangers/supports, & equipment hangers/supports.

B. Structural Performance: Hangers and supports for HVAC piping, ductwork, and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE Standard 7-16.

1. Design hangers/supports for piping, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design hangers/supports for ductwork and associated accessories.
3. Design equipment hangers/supports capable of supporting combined operating weight of supported equipment, including connected systems and components.
4. Design seismic restraint hangers and supports for piping, ductwork, and equipment. See Section 230540 (Seismic Bracing for HVAC Systems).
5. Design of connections for hangers, supports, and bracing shall comply with the requirements indicated on the structural drawings.

2.2 GENERAL MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers shall be same or similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory mixed and packaged, dry hydraulic cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.
   1. Properties: Non-staining, non-corrosive, and non-gaseous.
   2. Design Mix: 5,000 psi, 28 day compressive strength.

2.3 HVAC EQUIPMENT HANGERS AND SUPPORTS

A. Provide delegated design as applicable for the specific equipment.

2.4 DUCTWORK HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electro-galvanized, all-thread rods, or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Table 5-1 (Minimum Hanger Sizes for Rectangular Ducts) and Table 5-2 (Minimum Hanger Sizes for Round Ducts).

D. Steel Cables for Galvanized Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cables for Stainless Steel Ducts: Stainless steel complying with ASTM A492.

F. Steel Cable End Connections: Galvanized steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports
   1. Supports for Galvanized Steel Ducts: Galvanized steel shapes and plates.
   2. Supports for Stainless Steel Ducts: Stainless steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.5 HVAC PIPE HANGERS AND SUPPORTS

A. Carbon Steel Pipe Hangers and Supports
   1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
   2. Galvanized Metallic Coatings: Pre-galvanized, hot dip galvanized, or electro-galvanized.
   3. Non-Metallic Coatings: Plastic coated or epoxy powder coated.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support the bearing surface of the piping.
   5. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

B. Stainless Steel Pipe Hangers and Supports
   1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   3. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

C. Copper Pipe and Tube Hangers
   1. Description: MSS SP-58, Types 1 through 58, copper plated steel, factory fabricated components.
   2. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

2.6 HANGER AND SUPPORT MATERIALS

A. Additional hanger and support requirements are listed in sections specifying piping, ductwork, and equipment.

B. Comply with MSS SP-58 for pipe hanger selections and applications that are not specified in piping system sections.

C. Use hangers and supports with galvanized metallic coatings for piping, ductwork, and equipment that will not have field applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger shield inserts for insulated piping and tubing.

I. Horizontal Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes 1/2” thru 30” size.
2. Yoke Type Pipe Clamps (MSS Type 2): For suspension of up to 1050°F, pipes 4” thru 24” size, requiring up to 4 inchesof insulation.
3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes 3/4” thru 36” size, requiring clamp flexibility and up to 4 inchesof insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes 1/2” thru 24” size if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes 1/2” thru 4” size, to allow off center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split or Solid Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes 3/4” thru 8” size.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
9. Adjustable, Swivel Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes 3/8” thru 8” size.
11. Extension Hinged or Two Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes 3/8” thru 3” size.
12. U-Bolts (MSS Type 24): For support of heavy pipes 1/2” thru 30” size.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes 4” thru 36” size, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes 4” thru 36” size, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion type support for pipes 2-1/2” thru 3” size, 6” size if vertical adjustment is required, with steel pipe base stanchion support and cast iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes 1” thru 3” size, from two rods if longitudinal movement caused by expansion and contraction may occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes 2-1/2” thru 24” size, from single rod if horizontal movement caused by expansion and contraction may occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2” thru 42” size if longitudinal movement caused by expansion and contraction may occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes 2” thru 24” size if small horizontal movement caused by expansion and contraction may occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes 2” thru 30” size if vertical and lateral adjustment during installation may be required in addition to expansion and contraction.

J. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers 3/4” thru 24”.
   2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers 3/4” thru 24” size if longer ends are required for riser clamps.

K. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inchesfor heavy loads.
   2. Steel Clevises (MSS Type 14): For 120°F to 450°Fpiping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120°F to 450°Fpiping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
   6. C-Clamps (MSS Type 23): For structural shapes.
   7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
   8. Side Beam Clamps (MSS Type 27): For bottom of steel I-beams.
   9. Steel Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
   10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lbs.
    b. Medium (MSS Type 32): 1,500 lbs.
    c. Heavy (MSS Type 33): 3,000 lbs.
13. Side Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Steel Pipe Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Restraint Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary, to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe hanger selections and applications that are not specified in piping system sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system sections.

Q. Use powder actuated fasteners and mechanical expansion anchors instead of building attachments where required in concrete construction.

2.7 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop or field fabricated pipe support assembly made from structural carbon steel shapes with MSS SP-58 carbon steel hanger rods, nuts, saddles, and U-bolts.

2.8 METAL FRAMING (STRUT) SYSTEMS

A. Metal Framing Manufacturers Association (MFMA) Metal Framing Systems

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

   B-line
   Unistrut
   Flex-Strut
   G-Strut
   Miro Industries

2. Description: Shop or field fabricated, pipe support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory fabricated components for field assembly.
4. Channels: Continuous slotted carbon steel channel with in-turned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.
8. Metallic Coating: Zinc dichromate finish applied over an electro-galvanized zinc plating.

2.9 THERMAL HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:
   Pipe Shields
   nVent/Caddy
   Buckaroos

B. Standard Insulation Insert Material for Cold Piping: Polyisocyanurate high density insulation, with 125 psiminimum compressive strength, a flame spread/smoke developed rating of 25/50 or less, and vapor barrier.

C. Standard Insulation Insert Material for Hot Piping: Polyisocyanurate high density insulation, with 125 psiminimum compressive strength, a flame spread/smoke developed rating of 25/50 or less; or calcium silicate with 100 psiminimum compressive strength.

D. Structural/Seismic Insert Material for Cold Piping: Polyisocyanurate high density insulation, with a minimum density of 14 lbs/ft^3, a minimum compressive strength of 900 psi, and a flame spread/smoke developed rating of 25/50 or less. Structural inserts shall be used as recommended by the insert manufacturer to meet load ratings.

E. Structural/Seismic Insert Material for Hot Piping: Calcium Silicate with a minimum density of 28 lbs/ft^3 and a minimum compressive strength of 900 psi. Structural inserts shall be used as recommended by the insert manufacturer to meet load ratings.

F. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

G. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

H. Insert Length: Extend 2 inchesbeyond sheet metal shield for piping operating below ambient air temperature.

I. Provide a vapor barrier steel jacket around insulation. Insulation jackets shall be galvanized steel conforming to ASTM A653. Hanger bearing surface shall consist of a galvanized sheet metal insulation protection shield or casing.

J. Thermal hanger supports shall be load rated. Load ratings shall be established by the pipe support manufacturer based upon testing and analysis in conformance with the current edition of following codes and standards: ASME B31.1, MSS SP-68, SP-69, and SP-89.

K. Unless otherwise indicated, thermal hanger supports shall be as indicated in the following schedule, or approved equal. The listed model numbers are based on Pipe Shields.
   1. Pipe supported on hangers: Models A2000, A4000, A9000, and D3000 series.
   2. Pipe supported on flat surfaces: Models A2000, A4000, A6000, A7000, A7200, and A7400.
   3. Pipe Supported on pipe rolls: Models A4000, A6000, A8200, and A8400.
   4. Pipe supported on slides and guides: Model B series.
   5. Riser pipe supports: Model E series.

L. The selected model(s) shall conform to pipe service, support style, and support spacing.

M. Pipe support spacing shall be in accordance with the manufacturer's recommendations, but in no case shall exceed the maximum spacing required by ASME B31.1.

2.10 FASTENER SYSTEMS

A. Powder Actuated Fasteners: Threaded steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Powder actuated fasteners may only be utilized for point loads of 50 lbs or less.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Hilti
      ITW Ramset (Red Head)
      Simpson Strong-Tie

B. Mechanical Expansion Anchors: Insert wedge type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated stainless steel.
   2. Outdoor Applications: Stainless steel.
   3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Hilti
      ITW Ramset/Red Head
      B-line

2.11 PIPE STANDS

A. General Requirements for Pipe Stands: Shop or field fabricated assemblies made of manufactured corrosion resistant components to support roof mounted piping.

B. Compact Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Single base unit with integral rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
   3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   4. Hardware: Galvanized steel or polycarbonate.
   5. Accessories: Protection pads.

C. Low Profile, Single Base, Single Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
   3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   4. Vertical Members: Two galvanized steel, continuous thread 1/2 inchrods.
   5. Horizontal Member: Adjustable horizontal, galvanized steel pipe support channels.
   6. Pipe Supports: Roller strut clamps, clevis hanger, or swivel hanger.
   7. Hardware: Galvanized steel.
   8. Accessories: Protection pads.
   9. Height: 12 inchesabove roof, or as indicated on the drawings.

D. High Profile, Multiple Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   3. Bases: Two or more vulcanized rubber molded polypropylene insert material.
   4. Vertical Members: Two or more galvanized steel channels.
   5. Horizontal Members: One or more adjustable height, galvanized steel pipe supports.
   6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
   7. Hardware: Galvanized steel.
   8. Accessories: Protection pads**,** 1/2 inchcontinuous thread rod.
   9. Height: 24 inchesabove the roof or as indicated on the drawings.

E. Curb Mounted Type Pipe Stands: Shop or field fabricated pipe supports made from structural steel shapes, continuous thread rods, and rollers, for mounting on permanent stationary roof curb.

2.12 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment supports made from structural carbon steel shapes.

2.13 OUTDOOR EQUIPMENT STANDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

Miro Industries
Rooftop Support Systems

B. Description

1. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof supported outdoor equipment components, without roof membrane penetration, in a pre-fabricated system that can be modularly assembled on site.
2. Foot Material: Rubber or polypropylene.
3. Rails Material: Hot dip galvanized carbon steel.
4. Wind/Sliding Load Resistance: Up to 120 mph, or as indicated on the structural drawings.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with all requirements in other section of the specifications for firestopping materials and installation for penetrations through fire rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M, carbon steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation

1. Install powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inchesthick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.
2. Install mechanical expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation
   1. Pipe Stand Types Except Curb Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate the roof membrane.
   2. Curb Mounted Type Pipe Stands: Assemble components or fabricate pipe stands and mounts on a permanent, stationary roof curb.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2” pipe size and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation. Optional: Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees. Optional: Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipes 4”and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. 1/2” to 3-1/2” pipe: 12 incheslong and 0.048 inchthick.
      b. 4” and 5” pipe: 18 incheslong and 0.06 inchthick.
      c. 8” thru 14” pipe: 24 incheslong and 0.075 inchthick.
      d. 16” thru 24” pipe: 24 incheslong and 0.105 inchthick.
   5. Pipes 8”and Larger: Include wood or reinforced calcium silicate insulation inserts of length at least as long as the protective shield.
   6. Thermal Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT HANGERS/SUPPORTS

A. Fabricate structural steel supports to suspend equipment from structure overhead or structural steel stands to support equipment above the floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing for equipment supports to prevent swaying.

3.4 DUCTWORK HANGERS/SUPPORTS

A. Fabricate structural steel supports to suspend ductwork from structure overhead.

B. Fabricate structural steel stands to support ductwork above the floor (when indicated on the drawings). Provide lateral bracing for ductwork supports to prevent swaying.

3.5 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.6 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous thread hanger and support rods to 1-1/2 inches.

3.7 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780/A780M.

END OF SECTION

SECTION 23 05 40 - SEISMIC BRACING FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 230000 (Heating, Ventilating, and Air Conditioning), Section 230500 (Basic Materials and Methods for HVAC), and Section 230530 (Hangers and Supports for HVAC Systems) are hereby made a part of this section.

1.2 GENERAL

A. Seismic bracing for mechanical systems (equipment, ductwork, piping, and conduit) shall comply with all applicable requirements of the latest adopted edition of the International Building Code (IBC) including all applicable provisions of the latest adopted edition of the American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures (ASCE Standard 7-16). Basic seismic design criteria for each project shall be as listed on the structural drawings for that project.

B. The anchorage calculations shall show compliance with the latest adopted edition of the American Concrete Institute (ACI) Standards, Handbooks, and Manuals where anchoring to concrete for the project-specific loads and conditions, including project specific calculations for anchors, clips, and fasteners.

C. Anchorage calculations for seismic roof curbs shall be included in seismic roof curb submittal, including a stamped plan or detail showing the anchorage requirement. This detail shall include specific anchor type, diameter, embedment, and layout or spacing. The anchorage calculation shall show compliance with the American Concrete Institute (ACI) where anchoring to concrete for the specific loads and conditions present, including project specific calculations for anchors, clips, and fasteners.

D. Compliance with the applicable seismic bracing requirements for equipment, ductwork, piping, and conduit shall be accomplished utilizing the most current version of one of the following design manuals, or approved equal.

International Seismic Application Technology (ISAT) Design Manual

Mason Industries Seismic Restraint Design Manual

Vibro-Acoustics Seismic Design Manual

SMACNA Seismic Restraint Manual (Guidelines for Mechanical Systems)

E. Component Importance Factors (Ip) for all equipment, ductwork, piping, and conduit shall be determined and assigned in accordance with ASCE Standard 7-16 Section 13.1.3.

F. Design and detailing of seismic bracing, hangers, and supports for equipment, ductwork, piping, and conduit is the responsibility of the Contractor.

G. Design of connections for hangers, supports, and bracing shall comply with the requirements indicated on the structural drawings (when provided).

H. The work of this section shall be coordinated with the requirements for the Contractor furnished delegated design submittal for hangers and supports specified in Section 230530 (Hangers and Supports for HVAC Systems). Design and detailing of seismic bracing, hangers, and supports is the responsibility of the Contractor.

1.3 SUBMITTALS

A. The Contractor shall provide the required number of seismic shop drawing submittal sets for review and approval by the Engineer. Submittals shall include a comprehensive set of shop drawings clearly depicting the seismic bracing requirements for all equipment, ductwork, piping, and conduit. Any piping or conduit that does not require seismic bracing shall be specifically identified in the submittal, and the reason for exemption shall be provided. Cite any and all references for the exemption. In cases where seismic bracing is not required due to the supported items being less than 12 inches below the supporting structure, a single note may be provided to cover those locations.

B. Submittals shall be fully coordinated with the structural drawings and shall include all applicable structural attachment details. Seismic bracing shop drawings shall include all vertical support anchorage loads and all seismic bracing anchorage loads. Each specific load shall be indicated and the structural element that the support is attached to shall be clearly depicted/identified. Seismic bracing submittals shall be stamped and signed by a structural engineer with current registration licensed in the State of Nevada (or licensed in the state where the project is located, if the project is located outside the State of Nevada).

C. Seismic shop drawing submittals will be reviewed by both the design mechanical engineer and the design structural engineer.

1.4 SITE VISITS (QUALITY CONTROL)

A. An authorized representative of the seismic bracing system manufacturer shall visit the job site during the construction period to confirm that the seismic bracing installation complies with the shop drawings, with all applicable code requirements, and with the seismic bracing system manufacturer's written installation requirements and associated details. As a minimum, an authorized representative shall visit the site when the seismic bracing installation is complete (and prior to installation of the ceilings).

B. A written report shall be issued within one week the site visit summarizing the observations made during the site visit and listing all required corrective actions and/or deficiencies. The report shall be made available to both the design mechanical engineer and the design structural engineer.

C. After all equipment installation is complete and all seismic bracing has been verified, the authorized representative that conducted the field verification shall issue a letter certifying that the installation is complete and that the installation complies with the specified requirements.

D. Site visits shall be coordinated with the Owner and shall be scheduled in writing a minimum of one week prior to the proposed site visit date.

END OF SECTION

SECTION 23 07 00 - INSULATION FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of mechanical insulation specified in this section include the following:

1. Piping Systems Insulation
   Condensate Drain Piping
   Refrigerant Piping
2. Ductwork Systems Insulation
   Supply Air and Return Air Ducts
3. Equipment Insulation
   Removable Insulating Jackets
   Roof-Mounted Mechanical Equipment Curbs

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Insulation specialty firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. IECC Compliance: Comply with applicable portions of the International Energy Conservation Code, including, but not limited to Section C403.13.

C. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) recommendations for all work in this section.

D. ASHRAE Standards: Comply with applicable portions of American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommendations for all work in this section.

E. NFPA Standards: Comply with applicable portions of ANSI/NFPA Standard 90A (Standard for the Installation of Air Conditioning and Ventilating Systems) and ANSI/NFPA 90B (Standard for the Installation of Warm Air Heating and Air Conditioning Systems) for all work in this section.

F. NAIMA Standards: Comply with all applicable portions of the North American Insulation Manufacturers Association (NAIMA) standards for all related work in this section.

G. MICA Standards: Comply with all applicable portions of the Midwest Insulation Contractors Association standards for all related work in this section.

H. Install thermal insulation products on equipment in accordance with the manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of insulation. Submit schedule showing manufacturer's product number, k-Value, thickness, density, and furnished accessories for each mechanical system requiring insulation. Include complete description of installation methods with this submittal.

PART 2 - PRODUCTS

2.1 PIPE INSULATION MATERIALS

A. All pipe insulation thicknesses and conductivities shall meet or exceed the requirements listed in International Energy Conservation Code Section C403.13. All conductivity values listed in this specification section are in Btu-in/(hr-ft^2-°F).

B. Flame/Smoke Spread Ratings: Insulation installed inside the building shall consist of composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with a flame spread rating of 25 or less and a smoke developed index of 50 or less, per ASTM E84.

C. Aluminum Jacketing shall be Johns Manville 'JM Aluminum Jacketing' with 'Polyfilm Moisture Barrier' and stucco-embossed finish, or approved equal, and shall be installed in conformance with the manufacturer's written instructions. Secure jacketing with 3/4" wide Type 304 stainless steel bands at 12" on center. Finish all cold fittings as required to provide a vapor-tight seal. Aluminum and/or stainless steel jacketing shall be provided in the following thicknesses:

1. For Insulation Outside Diameters under 8": .016 inch thick jacketing
2. For Insulation Outside Diameters 8" thru 24": .024 inch thick jacketing

D. Lower Level Exposed in all piping applications shall mean any exposed pipe in a mechanical room, mezzanine area, or other accessible space that is less than 8'-0" above finished floor.

E. Higher Level Exposed in all piping applications shall mean any exposed pipe in a mechanical room, mezzanine area, or other accessible space that is 8'-0" or more above finished floor.

F. Fiberglass Insulation (Concealed Applications)

1. Fiberglass insulation shall be Johns Manville Microlok HP, or approved equal, with factory-applied fire-retardant ASJ jacket, self-sealing laps, and shall be applied per manufacturer's written recommendations. Conductivity shall be 0.23 at 75°F, 0.25 at 125°F, and 0.28 at 200°F. Insulation shall be rated for applications from 0°F up to 850°F. Insulation flame spread/smoke developed rating shall be 25/50 or less in accordance with ASTM E84.
2. Insulate and cover all fittings with Johns Manville Zeston Series 2000 standard gauge pre-molded fitting covers secured with serrated tacks, adhesive, and/or Zeston Z-Tape.
3. Install a segment of rigid calcium silicate insulation at each pipe hanger for pipe sizes 2-1/2 inches and larger.
4. Finish all cold fittings with Zeston Z-tape to provide a vapor-tight seal.
5. Seal all raw ends and exposed fiberglass insulation with Childers CP-10 weather barrier sealant, or approved equal.
6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Johns Manville
   Knauf
   Owens Corning

G. Fiberglass Insulation (Lower Level Exposed Applications)

1. Fiberglass insulation shall be Johns Manville Microlok HP, or approved equal, with factory-applied fire-retardant ASJ jacket, self-sealing laps, and shall be applied per manufacturer's written recommendations. Conductivity shall be 0.23 at 75°F, 0.25 at 125°F, and 0.28 at 200°F. Insulation shall be rated for applications from 0°F up to 850°F. Insulation flame spread and smoke developed rating shall be 25/50 or less in accordance with ASTM E84. Lower level exposed piping shall be covered with aluminum jacketing.
2. Insulate and cover all fittings with aluminum jacketing and aluminum fitting covers.
3. Install a segment of rigid calcium silicate insulation at each pipe hanger for pipe sizes 2-1/2 inches and larger.
4. Finish all cold fittings with Zeston Z-tape to provide a vapor-tight seal.

5. Seal all raw ends of insulation with Childers CP-10 weather barrier sealant, or equal.
6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Johns Manville
   Knauf
   Owens Corning

H. Fiberglass Insulation (Higher Level Exposed Applications)

1. Fiberglass insulation shall be Johns Manville Microlok HP Ultra with performance characteristics as specified for Johns Manville Microlok HP insulation plus a factory-applied polypropylene coating that is cleanable/washable.
2. Insulate and cover all fittings with Johns Manville Zeston Series 2000 standard gauge pre-molded fitting covers secured with serrated tacks, adhesive, and/or Zeston Z-Tape.
3. Install a segment of rigid calcium silicate insulation at each pipe hanger for pipe sizes 2-1/2 inches and larger.
4. Finish all cold fittings with Zeston Z-tape to provide a vapor-tight seal.
5. Seal all raw ends of insulation with Childers CP-10 weather barrier sealant, or equal.
6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Johns Manville
   Knauf
   Owens Corning

2.2 CONDENSATE DRAIN PIPING (INDOORS)

A. Insulate condensate drain piping installed inside the building with fiberglass Insulation. Insulation is not required on condensate overflow drain piping.

1. Minimum Insulation Thickness for all pipe sizes: 1/2 inch

2.3 REFRIGERANT PIPING INSULATION (INDOORS)

A. Insulate refrigerant suction piping installed indoors with 3/4 inch thick AP Armaflex closed cell foam pipe insulation. Flame spread and smoke developed rating shall be 25/50 or less in accordance with ASTM E84. Fittings and valves shall be covered with segmented sections of the pipe insulation installed in accordance with the insulation manufacturer's instructions. All joints between sections of insulation shall be sealed with Armaflex No. 520 adhesive.

B. Insulate both liquid and suction lines on mini-split system heat pumps and variable refrigerant systems that incorporate heat recovery using the aforementioned insulating materials.

2.4 REFRIGERANT PIPING INSULATION (OUTDOORS)

A. Insulate refrigerant piping installed outdoors with 1 inch thick Johns Manville Trymer 25-50 with vapor retarder film, covered with Polyguard ‘Alumaguard’ all-weather flexible weatherproofing jacketing. Note that Trymer 25-50 closed cell polyisocyanurate insulation is required on outdoor refrigerant piping because it does not expand and contract during weather extremes like AP Armaflex closed cell foam pipe insulation.

B. Insulate both liquid and suction lines on mini-split system heat pumps and variable refrigerant systems that incorporate heat recovery using the aforementioned insulating materials.

2.5 DUCTWORK INSULATION MATERIALS

A. All duct insulation thicknesses and conductivities shall meet or exceed the requirements listed in International Energy Conservation Code Section C403.13. All conductivity values listed in this specification section are in Btu-in/(hr-ft^2-°F).

B. See Specification Section 233100 (HVAC Ductwork) for additional related requirements.

C. Ductwork Insulation (General)

1. All concealed supply air ductwork (rectangular and round) shall be externally insulated unless indicated otherwise on the drawings.
2. All concealed return air ductwork (rectangular and round) that is located in a return air plenum is not required to be insulated, unless indicated otherwise on the drawings.
3. Supply air and return air ductwork that is exposed in a conditioned space does not require insulation.

D. Ductwork Liner Insulation (See Specification Section 233100 (HVAC Ductwork).

E. External Duct Wrap Insulation

1. Unless indicated otherwise, wrap all concealed supply air and return air ductwork with 2-1/5 inch thick, 0.75 pcf density, fiberglass duct insulation with reinforced foil facing (Johns Manville Microlite FSK Type 75, or equal, with an R-value equal to 6.0).
2. Any exposed supply air or return air ductwork that is indicated on the drawings to be insulated shall be insulated with Johns Manville PSK white or black insulation, or approved equal, with matching PSK seaming tape.
3. In addition to the insulation manufacturer's tape flap, all insulation seams shall be sealed with pressure-sensitive tape (Shurtape AF-984CT, or equal). Longitudinal seams shall have a 4 inch overlap of the foil facing secured with outward clinching staples and pressure sensitive tape.
4. Secure insulation on the underside of ducts that are 24 inches wide and above with either weld pins or with Duro-Dyne PBH Dynastick Fasteners adhered with Duro-Dyne PBACZVOC Dynastick Adhesive. Weld pins or fasteners shall be placed on 18" centers and within 6 inches of insulation seams. Any penetrations from pins in the insulation shall be sealed with pressure-sensitive tape.
5. In addition to the aforementioned fastening and seam sealing procedures, all external duct wrap insulation shall be secured with 16 gauge galvanized wire tied on 16" centers and within 8 inches of insulation seams.

2.6 EQUIPMENT INSULATION MATERIALS

A. General: All equipment insulation R-Values and thicknesses shall meet or exceed the requirements listed in 2024 International Energy Conservation Code Section C403.13.

B. Removable Insulating Jackets

1. Removable insulating jackets shall be provided for the following items:
   Motorized control valves located indoors and/or outdoors
   Flanged valves located indoors and/or outdoors
2. Insulation and jacket material shall be rated for the operating temperature of the equipment and/or fluid being insulated. Insulating jackets shall be removable and reusable, thermal and acoustical insulating jackets, constructed of minimum 18 ounce material, and sewn with Kevlar thread.
3. Jackets for applications above 250°F (i.e., high temperature hot water valves in exterior valve vaults) shall be fabricated with either silicone or PTFE coated fiberglass fabric inner and outer material, and minimum 4" thick needled fiberglass insulation (see pipe insulation section for required thickness based on pipe size and temperature). The inner layer shall include a stainless steel mesh liner.
4. Jackets for hot water applications 250°F and below (e.g., hot water valves in exterior valve vaults) shall be fabricated with PTFE-coated fiberglass fabric inner and outer material and minimum 2" thick needled fiberglass insulation (see pipe insulation section for required thickness based on pipe size and temperature).

5. Jackets for coldwater applications shall be fabricated with PTFE-coated fiberglass fabric inner and outer material and 1” thick needled fiberglass insulation.
6. Insulating jackets shall be secured with stainless steel d-rings with straps and Velcro fasteners.
7. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Insultech
   MIT International
   Thermal Energy Products

C. New Roof-Mounted Mechanical Equipment Curbs: The Contractor shall install insulation on the interior perimeter of mechanical equipment curbs as indicated or detailed on the drawings and as indicated herein. Insulation shall be two layers of 2 inch thick, rigid closed cell polyisocyanurate insulation, R-Max Thermasheath, or approved equal. Insulating value shall be R-13.1. Secure and/or adhere the insulation in accordance with the insulation manufacturer’s written instructions (typically with adhesive and washers with pins or screws).

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING INSULATION

A. The term ‘piping’ used herein shall include pipe, valves, strainers, and fittings. Apply insulating cements to fittings, valves, and strainers, and trowel smooth to the thickness of adjacent covering. Covering on valves shall extend up to the bonnet. The covering cement shall be of the types specified herein.

B. Install all insulation products in accordance with the manufacturer's written instructions and in accordance with recognized industry practices.

C. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.

D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full length units of insulation, with single-cut pieces to complete each run. Do not use cut pieces or scraps abutting each other.

E. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

F. Extend piping insulation without interruption through walls, floors, and similar penetrations, except piping through fire walls.

G. Install pipe hangers on the outside of the insulation and not in contact with the pipe. Protect insulation as specified in Specification Section 230500 (Basic Materials and Methods for HVAC Systems) under ‘Hangers and Supports for Ductwork and Piping’.

H. Install a 6 inch long section of rigid insulation at each pipe saddle and/or hanger. Rigid sections shall be calcium silicate.

I. Seal all raw ends of insulation with Childers CP-10 weather barrier sealant, or approved equal.

3.2 INSTALLATION OF DUCTWORK INSULATION

A. Install insulation products in accordance with the manufacturer's written instructions and in accordance with these specifications.

B. Extend ductwork insulation without interruption through walls, floors, and similar penetrations, except ductwork through fire rated walls and where otherwise indicated.

C. Except where otherwise indicated, external duct insulation may be omitted on ductwork where internal duct liner insulation has been specified.

D. Except where otherwise indicated, ductwork exposed in conditioned spaces is not required to be insulated.

3.3 INSTALLATION OF EQUIPMENT INSULATION

A. Install all equipment insulation materials with smooth and even surfaces and on clean and dry surfaces. Replace any poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

B. Do not apply insulation to equipment, flues, breechings, or stacks while hot.

C. Do not insulate cleanouts, ASME stamps, or equipment manufacturer's nameplates. Provide neatly beveled edges at interruptions of insulation.

3.4 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective insulation. Leave entire work in condition satisfactory to the Architect/Engineer. At completion, carefully clean equipment installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.5 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 08 00 - TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

B. Section 230910 (Sequence of Operation) is hereby made a part of this section.

1.2 WORK INCLUDED

A. Temperature performance testing on all heat transfer equipment and/or components.

B. Test and balance of air distribution systems and associated equipment and apparatus.

C. Test and balance of hydronic distribution systems and associated equipment and apparatus.

D. Testing, setting, and adjusting speed and volume of systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by the contract documents.

E. Component types of testing, adjusting, and balancing specified in this section includes the following as applied to mechanical equipment:
Piping Systems
Rooftop Units
Fans
Ductwork Systems
Air Distribution
Balancing Valves for Plumbing Systems

1.3 QUALITY ASSURANCE

A. Balance Agency: Provide services and facilities of an independent agency that specializes in testing, analysis, and balancing of hydronic systems and air distribution for heating and/or cooling systems. Work shall be done by qualified engineering technicians and trained personnel, using instruments certified accurate to limits used in standard practice for testing and balancing of hydronic and air distribution for heating and cooling systems. The balance agency shall field test air and hydronic flows in accordance with the methods prescribed by the Associated Air Balance Council, National Standard Volume 1, latest edition.

B. The balance agency shall be a member of the Associated Air Balance Council. Subject to compliance with requirements, the balance agency shall be one of the following (no exceptions):

RS Analysis
Raglen System Balance

C. The balance agency shall submit the results of tests in this section to the Architect/Engineer for review and acceptance.

D. AABC Compliance: Comply with AABC ‘National Standards’ Volume 1, as applicable to mechanical air and hydronic distribution systems and associated equipment and apparatus.

E. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting and balancing, except as otherwise indicated.

F. Reference Standards

1. AABC (Associated Air Balance Council) AABC National Standards Volume 1.
2. ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers).

G. Test Instruments: Utilize test instruments and equipment for the test and balance work required, of type, precision, and capacity as recommended in AABC National Standards Volume 1.

1.4 SUBMITTALS

A. Provide a test and balance agenda that includes step-by-step testing and balancing procedures, test sheets, and schematic drawings, all being specific to the project.

B. Provide submittals to indicate the extent of work proposed. Submit certified test reports as hereinafter specified signed by test and balance technician/supervisor that performed test and balance work.

C. Include identification and types of instruments used and their most recent calibration date with submission of final test report.

D. The completed balance report shall be submitted for review and approval prior to requesting final observation of the project.

1.5 GENERAL REQUIREMENTS

A. The balance agency shall perform the following during the installation phase of systems:

1. Study the design drawings and specifications and prepare a schedule to physically inspect mechanical equipment for the hydronic and air distribution systems to be tested and balanced. The Contractor shall provide the balance agency with one copy of the contract drawings and specifications, mechanical equipment submittals, and change orders as necessary for proper balancing of the hydronic and air distribution systems.
2. The test and balance agency shall make field inspections prior to closing in portions of systems to be balanced. The balance agency shall verify that all work, fittings, dampers, balancing devices, etc. are properly fabricated and installed as shown or specified and that the balance agency will be able to properly balance the systems. Any problems or deficiencies shall be reported in writing to the Contractor, Mechanical Engineer, and CxA as soon as possible.
3. Prepare a testing and balancing schedule, test record forms, and necessary technical information regarding hydronic and air distribution systems for the installed heating and cooling equipment.
4. Provide written documentation when the above noted items have been completed, (see example checklist provided at the end of this section). A single page letter signed off by the mechanical contractor and the test and balance agency will suffice.
5. Recommend adjustments and/or corrections to mechanical equipment and hydronic and air distribution systems that are necessary for proper balancing of systems. Provide written documentation of the recommended items to the Architect/Engineer for review.

B. Patching Materials: Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork, and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes. At tester's option, plastic plugs with retainers may be used to patch drilled holes in low pressure ductwork and housings (2” w.g. and below).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TESTING AND BALANCING

A. Upon completion of hydronic and air handling systems, the test and balance agency shall complete tests, analysis, and balance of hydronic and air handling systems for all heating and cooling equipment.

B. The report shall include as minimum, design and actual information for the following:
   1. All mechanical equipment scheduled on the drawings.
   2. Motors, pumps, and fans: Horsepower, brake horsepower, revolutions per minute, actual amperage, full load rated amperage, pump flow and head data, etc.
   3. Air handling unit fan, filter, and heating & cooling section performance data.
   4. Air handling unit heat exchanger performance data (when applicable).
   5. Rooftop unit fan, filter, and heating & cooling section performance data.
   6. Supply, return, and exhaust fans: CFM, static pressure, and outlet velocity.
   7. Pumps: Suction, discharge, and shutoff pressures.
   8. Self-sensing pumps: Data as required for proper system operation, including balancing to the project specific self-sensing pump curves.
   9. Heat pumps: GPM flow and fluid temperatures, and air temperatures at inlet and outlet.
   10. Inlets, outlets, and main branch ducts: CFM and air velocity.
   11. All rooms: Air temperature during testing.
   12. Other information as required to establish completely balanced systems under design conditions.

3.2 BALANCING REQUIREMENTS AND TOLERANCES

A. All water systems, coils, and balancing valves shall be balanced to within 0 to +5% of design.

B. All air systems and air distribution devices (supply, return, and exhaust) shall be balanced to within 0 to +10% of design. This requirement applies to all main supply, return, and exhaust air ducts, as well as all air distribution devices.

C. On all air handling systems scheduled for 3,500 cfm or greater, make allowance for air filter resistance at the time of testing, by false-loading the filter bank with cardboard or other suitable material such that the test results can be repeated during the commissioning process.

D. When applicable, maintaining the designed space pressure relationships shall have priority over the tolerances specified above.

E. After final air and hydronic testing and balancing make necessary adjustments to obtain uniform temperatures during actual occupancy.

F. Take static pressure and air velocity readings with instruments that have been recently calibrated. Take final velocity readings with an Alnor velometer, Anemostat air meter, or vane type anemometer, all recently calibrated prior to testing. Include certified correction curves for each calibration as part of the record. Certify instruments are accurate to standards currently used in common practice for system balance work. Use test cones for diffusers.

G. Run tests with supply, return, and exhaust systems operating and doors, windows, etc. closed or under normal traffic. Conduct final testing with cooling coils under load to ensure that static pressures are or near design conditions.

H. Adjust deflection of supply outlets to ensure proper and uniform air distribution.

I. Work with the temperature control subcontractor in adjustment of automatic dampers, valves, thermostats, etc. as required to maintain proper temperatures in all portions of the building.

J. The Contractor responsible for installing heating, cooling, and ventilating equipment shall make any changes, additions, or modifications to dampers, fan drives, motor sheaves, pump impellers, motors, and other equipment as necessary for proper air and hydronic balance.

K. Balance of systems shall be reviewed by the Architect/Engineer. During this review the mechanical contractor shall furnish workmen, materials, ladders, etc. to enable the Architect/Engineer to witness all readings as may be directed. If any errors are found, the Testing and Balancing Agency shall readjust the system to the satisfaction of the Architect/Engineer.

L. The test and balance agency shall complete a Field Observation Report upon completion of the testing and balancing. See the following Field Observation Checklist Example.

3.3 PRE-SEASON STARTUP

A. Within one year of filing of the Notice of Substantial Completion, when all full load tests required under ‘Project Completion Tests and Startup’ and ‘Post Contract Completion Tests’ have not yet been performed, the Contractor shall perform startup of any equipment or systems required for heating or cooling season operation when such equipment and systems have remained shut down or remain to be tested under full load. The Contractor shall ensure that all equipment and systems are operating properly before being turned over for the first operational use by the Owner. All such testing shall occur within one year of filing the Notice of Substantial Completion. The Owner will be responsible for providing new air filters for the Contractor to install prior to this testing if necessary.

Field Observation Checklist (Example)			
YES	**NO**	**N/A**	
□	□	□	Is all ductwork intact?
□	□	□	Are all access doors installed and secured tightly?
□	□	□	Are any air distribution inlets or outlets missing?
□	□	□	Are all turning vanes installed correctly?
□	□	□	Is the ductwork, fan inlets and outlets, installed according to the plans and specifications?
□	□	□	Are all balancing dampers, including fire-smoke dampers, installed and accessible?
□	□	□	Are all terminal boxes, reheat coils, and reheat components installed and accessible?
□	□	□	Does the return air have an unobstructed path from each conditioned space back to the unit?
□	□	□	Is the building architecturally complete?
□	□	□	Are all doors, windows, ceilings, and partitions installed?
□	□	□	Are all filters installed correctly and have frames that will not allow leakage?
□	□	□	Are all coils clean and properly installed?
□	□	□	Are the automatic control dampers installed in the correct locations?
□	□	□	Are the fan housings & plenums sealed & installed according to the plans and specifications?
□	□	□	Are all flexible duct connections installed properly without kinks?
□	□	□	Are suitable duct traverse locations available wherever necessary?
□	□	□	Is all piping intact and free of leaks?
□	□	□	Are all pumps, piping, and equipment installed according to the plans and specifications?
□	□	□	Are all valves, flow meters, and temperature-pressure taps installed to allow for TAB?
□	□	□	Are all valves, flow meters, and temperature-pressure taps accessible?
□	□	□	Are all valves piped correctly?
□	□	□	Are all terminal unit coils installed and piped correctly, and accessible?
□	□	□	Have all piping systems been cleaned, flushed, and treated?
□	□	□	Are all air vents properly installed?
□	□	□	Are vibration isolators properly installed and adjusted?
□	□	□	Are all flexible coil connections installed properly?

Notes: This checklist is an example and shall be customized for each individual project.
N/A = Not Applicable to this project.

END OF SECTION

SECTION 23 09 00 - TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

B. Section 230910 (Sequence of Operation) is hereby made a part of this section.

PART 2 - SCOPE OF WORK

2.1 GENERAL

A. The control system shall provide direct digital control with a Windows-based user interface. Third party viewing software is not acceptable. The manufacturer and/or his authorized representative shall be responsible for all work under this section of the specifications. Only pre-approved manufacturers and contractors will be allowed and shall be as follows (no substitutions):

Manufacturers	Northern Nevada Contractors	Telephone
Alerton Controls	Cerris Systems (formerly BCS Controls)	(775) 826-8998

B. Furnish and install an energy management control system (EMCS) and direct digital control (DDC) system complete with computer terminal (when specified), modem, surge suppressor, operating software, and training. Install the temperature control system software (most current edition) on the existing computer at the using agency's office and on the computer at the project site (when an on-site computer is specified). When third party software is necessary to allow for control system programming and/or editing of graphic displays that software (most current edition) shall also be provided on each of the aforementioned computers.

C. There shall be no annual maintenance or licensing fees of any kind required to be paid by the Owner at any time during the ongoing use of the installed system and software. Licenses shall be issued and authorized as directed by the Owner. Licenses shall be issued such that they can be modified by the Owner without the permission of the contractor and/or local system integrator. Specific license wording and format shall be provided as part of the contractor's submittals.

D. On any project that involves removal of existing controls, the Owner shall be given an opportunity to identify any control devices that they would like to have turned over to them for potential future use.

E. The temperature control contractor shall assist the testing and balancing contractor with temporary adjustments of control system programming and setpoints as necessary for proper completion of the testing and balancing scope of work.

F. Alerton Controls System

1. The Alerton Controls System shall be configured with multiple Ethernet connections to allow for remote network access and for direct connection of multiple computers via local area network. The Alerton Controls system shall utilize 'Compass' web-based graphic interface software (most current version). Communication with equipment controllers shall be via BACnet IP Ethernet backbone at 100.0 Mbps minimum speed. Controllers for central plant equipment and/or air handling units shall be Alerton ACM series with AXM expansion I/O modules or Alerton VIP series equipment controllers. All equipment controllers shall be furnished with integral hand-off-auto switches. Communication between equipment controllers and application specific controllers (Alerton VLC series) shall be via BACnet MS/TP network at 76.8k minimum speed.

2.2 SPARE CONTROLLER CAPACITY

A. All controllers for central plant equipment and air handling units (except application-specific controllers for unitary equipment) shall be furnished with a minimum of 10 percent spare capacity to allow for addition of both analog and digital inputs and outputs.

2.3 SUBMITTALS

A. The written control sequences, initial setpoints, dead-bands, and the graphic displays shall all be reviewed and confirmed with the Owner and the Engineer prior to preparing and forwarding the finalized submittals.

B. The submittals shall include complete written control sequences for each item of equipment requiring control. The sequences shall include all setpoints, dead-bands, etc. required for successful operation of the specified equipment. The submitted sequences shall include all necessary sequencing details, whether or not those details are furnished as part of the mechanical engineer's written control sequences (such details are commonly excluded from the Engineer's written control sequences) and all work associated with developing and incorporating those details shall be provided by the Temperature Controls Contractor at no additional cost to the Owner.

C. The Temperature Control Contractor shall prepare and submit a complete listing of BACnet points that are to be set up as trended and stored historical data. The list shall be broken down to include each system and/or item of equipment and shall be reviewed with the Owner and the Engineer for approval prior to setting up the trending in the temperature control system. The BACnet trend log names shall also be provided for approval.

2.4 AS-BUILT DOCUMENTATION

A. After all temperature control sequences have been finalized and have been approved by the Owner and the Engineer, and after the HVAC systems commissioning process has been completed, the Contractor shall provide as-built documentation which shall include both an electronic copy and a hard copy of the finalized as-built documentation and programming.

B. The as-built documentation shall include the following as a minimum:
   1. Include the final sequence of operation, including any adjustments that were made during commissioning.
   2. Include finalized programming flow charts or line code as applicable.
   3. Depict accurate wiring 'pathways' on a separate wiring floor plan.
      a. The sequential order of how the equipment is wired in the daisy-chained wiring floor plan shall match the sequential order of how the equipment is laid out in the overall network diagram.
      b. The wiring floor plan shall include delineation indicating the type of communication wiring used.
      c. The final location of all room temperature sensors shall be depicted on the wiring floor plan.
      d. The final location of all occupancy sensors shall be depicted on the wiring floor plan (when applicable).
      e. Provide a legend on the wiring floor plan indicating both the controller addresses and the equipment tag numbers.
   4. The equipment flow diagrams shall include accurate equipment configurations, and all installed control componentry (actuators, sensors, etc.).
   5. The equipment flow diagrams shall include the input and output numbers (for example, AO1 = Analog Output 1, BO2 = Binary Output 2, BI3 = Binary Input 3) which shall accurately match the tagging and numbers shown in the associated controller diagrams.

2.5 TRAINING

A. Upon completion of the commissioning process, the Temperature Controls Contractor shall instruct the Owner's designated personnel on the operation of all control system software features, shall provide a complete explanation of the control sequence for each item of equipment, and shall provide instructions on the operation and maintenance of all control devices. Training time shall be a minimum of 8 total hours (consisting of 2 separate 4 hour sessions).

2.6 WARRANTY PERIOD SERVICES

A. The Contractor shall provide full service for the temperature control system for a period of one year after the date of substantial completion. Service shall include, as a minimum, calibration of all sensors and other control devices, adjustments to setpoints, and modifications to control sequences and/or programming as required or requested to fine-tune and/or finalize all control sequences.

B. The Contractor shall provide a scheduled monitoring and reporting service for the duration of the one year warranty period. Monitoring shall be conducted via the remote control system interface (via modem or network connection) and the associated report shall be issued via email the same day that the monitoring is conducted. Monitoring shall be conducted on a weekly basis, preferably on either Monday or Tuesday. Reports shall include a specific listing of all alarms, all equipment failures, any noted operational problems or irregularities, and a set of screen prints. The weekly reports shall be emailed to the Owner and the Engineer.

2.7 SOFTWARE AND PROGRAMMING REQUIREMENTS

A. Provide a security/password system with two passwords (username and password). The security/password system shall allow access based on user security level as follows:

Level 1 Viewing only
Level 2 Room temperature and occupancy schedule adjustment
Level 3 Adjustment of all setpoints
Level 4 Full access to all setpoints and programming

B. The Temperature Controls Contractor shall program the applicable holidays into the EMCS software for the five years following the date of the installation.

C. Equipment Schedules: Schedules shall be coordinated with the Owner. A separate or combined occupied/unoccupied schedule shall be provided for each air handling unit, fan coil unit, exhaust fan, and/or other individual air handling system as designated by the Owner.

2.8 GRAPHIC DISPLAYS

A. All temperature setpoints and all other setpoints identified as adjustable in the written control sequence shall be adjustable from the appropriate graphic display(s). Setpoints listed in the contract documents are for initial set-up and trial of system operations. Control system shop drawings shall utilize the same (or similar) written sequences with all setpoints, throttling ranges, and differentials identified. As-built drawings shall include this same information with final setpoints resulting from startup, testing, and adjustment.

B. Monitored points and alarms for each system shall be shown on the displays with full color graphics and real-time data as listed below. Where indicated, graphic displays shall be dynamic (animated). All graphic displays shall be submitted to the Owner and the Engineer for review and modification as directed.

C. All temperatures shall be displayed with zero decimal places.

D. All valve and damper positions shall be displayed as percent open and shall be displayed with zero decimal places.

E. All setpoints which are identified as ‘adjustable’ in the written control sequences shall be adjustable via the associated graphic displays (including deadband between room setpoints).

F. All occupied mode and unoccupied mode room temperature setpoints shall have an adjustable deadband (adjustable from the associated graphic display).

G. All displays specified to be dynamic shall depict motion (as a minimum, dynamic displays shall include chiller compressors, boiler burners, rotating fan wheels, and rotating pump impellers).

H. All setpoints adjustable from the graphic displays shall be programmed with the deadband on one side of the setpoint (not split evenly across the setpoint) unless otherwise specified.

I. All outputs shall be programmed with the capability for the user to override the controlled commands/positions via the associated graphic display (this requirement applies to all equipment, valves, dampers, fans, pumps, etc.).

J. Alarm data fields shall be displayed with a red text when an alarm condition exists.

K. A summary table shall be provided in the graphic screens to display the current status of each fire-smoke damper. The summary data shall also include the approximate location of each fire-smoke damper.

L. A set of zone temperature summary screens shall indicate the current room temperature setpoint and current room temperature for each zone. A separate global setpoint and deadband shall be assigned to all zones associated with each air handling unit. The zone summary screens shall also include additional information for each zone such as the remote setpoint and deadband, discharge air temperature, valve position, fan command, fan status, deadband setpoint(s), etc. Summary screen format, function, and required display data shall be coordinated with the Owner prior to developing the graphic displays.

M. Each zone shall be capable of being set to any of three setpoints (depending on which setpoint is selected). The three available setpoints shall be the global setpoint (a single setpoint for all associated zones), the remote setpoint (a separate individually adjustable setpoint for each zone), and the local setpoint (adjustable at the room sensor by utilizing a slide or dial type control on the room sensor). The local setpoint adjustment range shall be programmed to allow adjustment only between a fixed temperature range (typically between 73ºF and 75ºF - range to be confirmed with the Owner prior to programming).

N. The current total cfm of all vav boxes associated with each vav air handling unit shall be calculated and displayed on the appropriate air handling unit screen.

O. Each variable frequency drive shall be programmed to display command, status (via current sensor), input speed, output speed, and alarm/failure status (via alarm contacts at each vfd).

P. Floor Plan(s): Provide a display showing the building floor plan(s) with all space temperature sensors including identification of the associated terminal unit or fan coil unit number. Specifically identify each thermal zone on the associated floor plan (AutoCAD file with thermal zone borders can be obtained from the mechanical engineer at no cost to the Contractor).

Q. The current room temperature status shall be indicated utilizing custom thermal geometry outlines around each thermal zone with dynamic color and opacity based on the current zone temperature.

R. The finalized sequence of operation shall be inserted into the graphics for viewing as a pdf file.

2.9 SPECIALTY CONTROL DEVICES AND REQUIREMENTS

A. Outdoor temperature sensor (dry bulb only) shall be Mamac Systems Model TE-213-F with solar radiation and precipitation shield, Dwyer Model TE-RND with solar radiation and precipitation shield, or approved equal.

B. Current sensors for fan and pump motors less than one horsepower shall be split core digital output type and shall have an adjustable setpoint capability.

C. Duct temperature sensor probes shall have a minimum length of 6 inches and shall be selected with longer lengths when required to ensure accurate temperature readings and to avoid dead air spaces.

D. Averaging sensors and freeze sensors shall be a minimum length of 12 feet. Longer lengths and/or multiple sensors shall be provided as required to ensure adequate coverage of the entire surface of each coil. Sensors shall be sized to provide complete coil coverage based on the requirements listed herein. Averaging and freeze sensor capillaries shall be installed in a serpentine arrangement with coverage extending to within 6” of each coil perimeter edge (top, bottom, and side edges) and shall be installed such that there is no more than 12” between horizontal passes. Averaging sensors shall provide for averaging of the entire length of the capillary element rather than an average of individual sensing locations.

E. Carbon Dioxide (CO_2) sensors for indoor applications shall be Vaisala GMW90 series for wall mount applications, Model GMD110 for duct mount applications, or approved equal. There shall be no value displayed on the wall mount sensor (only displayed on the control system remote graphic interface). Carbon Dioxide (CO_2) sensors for outdoor wall mount applications shall be Vaisala GMP343 series, or approved equal.

F. Relative humidity sensors for indoor applications shall be Senva HT1-2A, Vaisala HMW92D, or approved equal.

G. Air filter differential pressure sensors shall be Dwyer Model MS2-X102, or approved equal. Dip switches for pre-filters shall be set for a 0 to 1” w.c. range, and dip switches for final filters shall be set for a 0 to 2” w.c. range.

H. Differential Pressure Sensors:

1. Differential pressure sensors for dry applications shall be Dwyer 650 Series, Veris Industries Model PX, Senva Model P4, or approved equal. Verify desired/required sensing range prior to submitting and/or ordering. Sensor tubing connections shall be fitted with brass test tees for use by the test and balance contractor for verification/calibration.
2. Differential pressure sensors for wet applications shall be Veris Industries PWRLX series, or approved equal. Verify the desired/required sensing range prior to submitting and/or ordering. Sensor tubing connections shall be fitted with brass test tees for use by the test and balance contractor for verification/calibration.

I. Sensors for room differential pressure shall have a control range of ± .10” w.c. Sensors shall be Veris Industries Model PX-01-F (fast response) or Setra Model 2641-0R1WB, furnished with Air Monitor Corporation Model SAP probes. Sensor tubing connections shall be fitted with brass test tees for use by the test and balance contractor for verification/calibration.

2.10 MISCELLANEOUS REQUIREMENTS

A. All control devices shall be installed in reasonably accessible locations. Control devices that may require occasional calibration or adjustment shall be given special consideration with regard to being installed in a reasonably accessible location.

B. Room temperature sensors shall be programmable touchscreen type and shall be provided with an override feature and setpoint adjustment with the ability to be limited or locked out via the operator workstation. The type of room sensor shall be confirmed with the Owner and the Engineer prior to issuing the associated submittal and prior to ordering.

C. Room temperature sensors shall be labeled with the corresponding terminal unit or fan coil unit number. Labels shall be self-adhesive with black lettering (1/8” height lettering).

D. Room temperature sensors installed on an exterior wall shall have a full thickness of insulation placed in the junction box behind the sensor.

E. Room temperature sensors in laboratory areas shall be sealed at the wall penetration behind the sensor to prevent air migration into the sensor from adjacent areas (due to the negative pressure of labs as compared to adjoining spaces).

F. Equipment specified to include a BACnet interface shall be provided with a terminal strip to allow remote control of the equipment via the direct digital control system (verify the specifics of this requirement on the equipment schedules and in the equipment specifications).

G. When an air handling unit is depicted as including a temperature sensor at the inlet and at the outlet of the chilled water and/or heating water coil those sensors shall be ‘paired thermistors’.

H. Sensor wells installed in a potable water system shall be stainless steel.

I. All control dampers in stainless steel ductwork shall be constructed of stainless steel and shall have flanged connections.

J. An as-built control diagram shall be laminated and secured inside of each temperature control panel prior to commencement of the final on-site mechanical systems commissioning sessions.

K. Trend logs shall be coordinated with the Owner and shall include as a minimum all temperature, pressure, gpm, cfm, percentage, status, and alarm data that is identified and requested.

L. Communication wiring at global controller(s) shall be physically labeled in the field to accurately reflect the equipment or device that it is connected to, so that the maintenance staff can quickly identify the associated equipment without going to the equipment location or looking at the as-builts.

M. Each piece of equipment shall have its own separate equipment controller, except for a project with terminal units (vav boxes). Grouping of multiple equipment items on a single controller is not acceptable. This is intended to ensure that failure of a single controller does not take down multiple pieces of equipment.

N. All low voltage wiring (whether plenum rated or not) shall be installed in raceways with the following conditions, clarifications, and exceptions.

1. Raceways shall be as defined in the National Electrical Code and open cable trays shall not be construed as meeting the definition of a raceway.
2. Low voltage wiring for temperature controls and energy management systems may be routed utilizing open cable trays above accessible ceilings. Low voltage wiring for temperature controls and energy management systems may also be installed utilizing appropriately spaced and neatly routed j-supports above accessible ceilings. Low voltage wiring routed in walls or at roof penetrations shall be installed in conduit.
3. Where open cable trays are utilized above accessible ceilings the following conditions apply.
    a. Low voltage wiring routed in open cable trays shall be plenum-rated (whether or not the ceiling space is utilized as a return air plenum).
    b. Low voltage wiring concealed in walls, floors, and above inaccessible ceilings shall be routed in raceways.
    c. Low voltage wiring routed between conduit stubs and cable trays shall be secured with appropriately spaced j-supports.

PART 3 - EXECUTION

3.1 PRE-SEASON STARTUP

A. Within one year of filing of the Notice of Substantial Completion, when all full load tests required under ‘Project Completion Tests and Startup’ and ‘Post Contract Completion Tests’ have not yet been performed, the Contractor shall perform startup of any equipment or systems required for heating or cooling season operation when such equipment and systems have remained shut down or remain to be tested under full load. The Contractor shall ensure that all equipment and systems are operating properly before being turned over for the first operational use by the Owner. All such testing shall occur within one year of filing the Notice of Substantial Completion. The Owner will be responsible for providing new air filters for the Contractor to install prior to this testing if necessary.

END OF SECTION

SECTION 23 09 10 - SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

B. Section 230900 (Temperature Controls) is hereby made a part of this section.

1.2 SEQUENCE OF OPERATION

EXHAUST FANS

EF-1 Restroom exhaust (enabled during scheduled occupied hours).

PACKAGED HEAT PUMP ROOFTOP UNIT WITH POWER EXHUAST

Occupied Mode

The rooftop packaged unit shall be enabled at the occupied time (unless enabled earlier by the optimum start program) and the heating, economizer, and cooling sections shall be modulated in sequence to maintain the room temperature setpoint (initially 75°F cooling setpoint, with a 5°F deadband, heating setpoint of 70°F). The unit is equipped with a BACnet interface that allows reading and writing to manage various functions utilizing the direct digital control system.

Approximately 12 points of data shall be programmed onto the associated graphic display for each packaged rooftop unit. The following list of data points shall be included as a starting place:

- ASHP Enable Status
- ASHP Supply Fan Status
- Alarm Status
- Cooling Section Enable Status
- Heating Section Enable Status
- OA Economizer Enable Status
- Supply Air Temperature
- Return Air Temperature

The variable frequency drive on the supply fan shall be adjusted by the test and balance contractor to achieve the scheduled supply air cfm with the unit operating with the scheduled minimum outside air cfm and with the filters false-loaded with cardboard or plastic sheeting to a pressure drop of 0.50” w.c. (to allow repeatability of the testing if necessary).

Outside air economizer mode shall be enabled whenever the outside air temperature is 2°F below the return air temperature (with a 2°F deadband, disabled when the outside air temperature equals the return air temperature). When outside air economizer mode is enabled and the outside air damper reaches the exhaust fan enable setpoint (initially 50% open, but then adjusted after testing the associated building area with all exterior doors closed, and adjusting the barometric relief dampers to verify that a reasonable positive building static pressure of approximately 0.02” w.c. is being achieved).

Unoccupied Mode

The rooftop packaged unit shall be disabled, the outside air damper shall be closed, the exhaust air damper shall be closed, and the return air damper shall be open.

Unoccupied Heating Mode

Same as occupied heating mode operation, except that during unoccupied heating mode operation the outside air damper shall be closed. Unoccupied heating mode shall be enabled whenever the room temperature falls below setpoint (55°F, adjustable, with a 5°F differential, off @ 60°F).

Unoccupied Cooling Mode

Same as occupied cooling mode operation, except that during unoccupied cooling mode operation the outside air damper shall be closed (except when economizer mode is enabled). Unoccupied heating mode shall be enabled whenever the room temperature rises above setpoint (85°F, adjustable, with a 5°F differential, off @ 80°F).

Optimum Start Mode (Morning Warm-Up and Morning Cool-Down Modes)
During morning warm-up and/or morning cool-down modes the air handling unit shall operate in accordance with the appropriate unoccupied mode sequence (Unoccupied Heating Mode or Unoccupied Cooling Mode). The optimum start period shall be limited to a maximum of 2 hours (adjustable) prior to the occupied time.

Unoccupied Override Mode
Whenever one of the room sensor override buttons is pressed during the unoccupied time period the packaged rooftop unit shall be enabled and controlled in the normal occupied mode for a period of 2 hours (adjustable).

Safeties
Whenever smoke is detected by a duct-mounted smoke detector the unit shall be disabled in accordance with the Unoccupied Mode sequence.

SPLIT SYSTEM HEAT PUMPS (HEATING AND COOLING)
The split system heat pump shall be controlled by the associated room thermostat (set to maintain the room cooling setpoint (78°F adjustable cooling setpoint, with a 10°F deadband, 68°F adjustable heating setpoint). An alarm condition shall be indicated on the associated graphic display whenever the room temperature rises above the high room temperature alarm setpoint (initially 82°F, adjustable).

The ddc control system shall display approximately 8 points of data for each split system heat pump via the associated BACnet interface (specific points to be selected during the submittal review process). The following list of data points shall be included as a starting place:

- Heat Pump Enable Status
- Heat Pump Alarm Status
- Current Mode (Heating or Cooling)
- Compressor Enable Status
- Compressor Operating Status
- Supply Air Temperature
- Return Air Temperature

OCCUPANCY SCHEDULES
Each air handling unit, rooftop unit, fan coil unit, and exhaust fan shall have its own separate occupied/unoccupied time schedule.

DESTRATIFICATION FANS
Each destratification fan shall be programmed for control of the occupied time schedule and fan speed via the required BACnet interface. The associated graphic display for each destratification fan shall include a minimum of 6 data points (specific objects to be determined during the submittal review process).

DOMESTIC HOT WATER RE-CIRCULATING PUMPS
The re-circulating pump shall be enabled continuously during occupied and unoccupied hours. An alarm condition shall be indicated whenever the pump fails (as determined by a current sensor).

SECTION 23 21 00 - HYDRONIC PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of hydronic piping and pumping systems specified in this section include the following:

Hydronic Piping, Valves, and Fittings
Condensate Drain Piping

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of hydronic piping products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering pumping equipment which may be incorporated in the work include the following:

Taco
Bell and Gossett

C. UL Compliance: Provide electric components for pumps which are UL listed.

D. Codes and Standards

1. ASME Compliance: Fabricate and install hydronic piping in accordance with ASME B31.9 (Code for Building Services Piping).
2. UMC Compliance: Fabricate and install hydronic piping in accordance with the Uniform Mechanical Code.

1.4 SUBMITTALS

A. As-Built Drawings: At project closeout, submit as-built drawings of installed hydronic pumps, piping, and hydronic specialties in accordance with all associated requirements.

B. Operation and Maintenance Data

1. Submit operation and maintenance data and parts lists for hydronic piping materials and products. Include this data, product data, shop drawings, and as-built drawings in operating and maintenance manual in accordance with all associated requirements.
2. Submit operation and maintenance data and parts lists for each type of pump, control, and accessory, including trouble-shooting maintenance guides.

C. Product Data

1. Submit manufacturers pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated. Pump efficiencies, as well as construction, will be taken into consideration.
2. Submit manufacturer's technical product data and installation instructions for each type of hydronic specialty.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with ASME B31.9 (Code for Building Services Piping) where applicable, base pressure rating on hydronic piping systems maximum design pressures or as specified. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in hydronic piping systems.

2.2 GENERAL PIPE AND PIPE FITTING REQUIREMENTS

A. General
   1. Provide pipe and tubing, joint type, grade, size, and weight indicated for each service, and complying with all governing regulations and industry standards.
   2. Remove scale, oxidation, slag, oil, grease, rust, dirt, and debris from inside and outside of pipe and fittings prior to assembly. Ream ends of pipe and tubes to remove burrs. Bevel plain ends of steel pipe.
   3. Cut all pipe threads using sharp dies. Tapered threads shall comply with ASME B1.20.1.

B. Copper Tube and Fittings
   1. Copper Tube: ASTM B88; Type L, hard drawn temper, except as otherwise indicated.
   2. Wrought Copper Solder Joint Fittings: ANSI B16.22.

C. Elbows
   1. All elbows in hydronic piping systems shall be long radius.
   2. Short radius elbows shall be utilized only where necessitated by space constraints. Such instances shall be submitted to the Engineer for review and approval.

D. Miscellaneous Piping Materials/Products
   1. General: Where applicable all pipe joining methods shall comply with the requirements of the ASME Boiler and Pressure Vessel Code.
   2. Welded Joints: Except as otherwise indicated, provide welding materials as determined by the Contractor to comply with all installation requirements and to comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
   3. Soldered Joints: Construct joints in accordance with ASTM B828 or the Copper Development Association ‘Copper Tube Handbook’ using lead free solder complying with ASTM B32. Apply ASTM B813 water-flushable flux, to tube ends, unless otherwise indicated.
   4. Brazed Joints: Construct joints in accordance with American Welding Society ‘Brazing Handbook’ using a copper-phosphorus brazing filler metal complying with American Welding Society Section A5.8 and with the ASME Boiler and Pressure Vessel Code.
   5. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.
   6. Gaskets for Flanged Joints: ANSI B16.21; full faced for cast iron flanges; raised face for steel flanges, unless otherwise indicated.

2.3 PIPE AND PIPE FITTING SYSTEMS

A. Cooling Coil Condensate Drain Piping: Type L, hard copper tubing with wrought copper solder joint fittings and 95 percent tin, 5 percent antimony solder. Condensate drain piping 1” and smaller shall use 45 degree wyes and long radius fittings at all changes in direction. Condensate drain piping 1-1/4” and larger shall use DWV fittings.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

A. The drawings, details, and diagrams indicate the general location and arrangement of the piping systems. The indicated piping locations and arrangements were utilized to determine appropriate pipe sizes and to calculate piping friction loss, expansion, system volume, pump sizes, and for other design considerations. Install piping as indicated unless deviations to the layout are identified and approved as part of the Contractor's shop drawings or submittals.

B. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak-proof piping systems, capable of performing each indicated service without piping failure.

C. Install each pipe run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16 inch misalignment tolerance.

D. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain), avoiding diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described in drawings, diagrams, details, and notations. If not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building and the equipment.

E. Hold piping close to walls, overhead construction, columns, and other structural and permanent building elements. Limit clearance to 1/2" where furring is shown for enclosure/concealment of piping. Locate insulated piping with 1" clearance outside of the insulation.

F. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

G. Electrical Equipment Spaces: Do not run piping through transformer vaults or other electrical or electronic equipment spaces and enclosures unless unavoidable. Install a drip pan under piping that must be run through electrical spaces and in all other locations indicated on the drawings.

H. Should structural difficulties or work of other contractors prevent the routing of pipes or the setting of equipment at the points shown on the drawings, the necessary deviations therefrom, as determined by the Contractor, with the Architect/Engineer's review and acceptance, will be allowed but must be made without additional cost to the Owner.

I. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.

J. Install exposed polished or enameled connections from fixtures or equipment with special care, showing no tool marks or threads at fittings.

K. Cap or plug openings in pipe and fittings immediately to exclude all dirt until fixtures are installed or final connections made.

L. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used.

M. Condensate Drain Piping: Run piping with downward pitch as indicated, without pockets.

N. Grade water circulating piping used for space heating and/or cooling up to high points at the rate of 1/4 inch in 10 feet in the direction of flow with returns grading down at same rate. Air vent valves specified hereinafter shall be installed at high points. Changes in pipe sizes shall be made with eccentric reducers flat on top.

O. Couplings shall not be used except where required pipe runs between fittings are longer than a standard length of the type of pipe being used and except where their use is specifically reviewed by the Architect/Engineer.

P. Conceal piping in finished portions of building, above the floor line, except where otherwise shown or noted. Cutting of walls and floors shall be held to the minimum possible to secure the proper installation.

Q. Install piping subject to expansion or contraction in a manner permitting strains to be evenly distributed and alleviated by expansion loops installed as required.

R. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeve.

3.2 FIELD QUALITY CONTROL (PRESSURE AND LEAK TESTING)

A. General

1. Prior to backfilling or concealment, all uninsulated underground chilled water piping shall be pressure and leak tested in accordance with this section and the pipe manufacturer's published testing procedures. Where conflicts exist between this specification and the manufacturer’s testing procedures, the more stringent requirement shall govern.
2. Any leaks detected during testing shall be repaired at the Contractor’s expense in accordance with Section 3.2(D).
3. Provide the manufacturer's published testing documentation and test forms prior to commencing the testing and submit the completed test forms upon completion of testing. Retain all signed test records and submit with the closeout documents.

B. Primary Test Method (Hydrostatic/Water)

1. Hydrostatic pressure testing using water as the test medium shall be the required primary testing method for all uninsulated underground piping systems.
2. Test pressure shall be the greater of 1.5 times the system design operating pressure, or the minimum test pressure specified in the pipe manufacturer's published testing procedures.
3. Maintain the required test pressure for a minimum of 2 hours, or longer if required in the pipe manufacturer’s published testing procedures. The system shall exhibit no measurable pressure drop and no visible leaks for the test to be considered acceptable.
4. Following completion of testing, fully drain and purge the system with compressed air if piping will not be placed into immediate service, or if ambient conditions present a risk of freezing prior to system startup.
5. Prior to pressurization, the system shall be completely filled with water and all entrapped air shall be purged. The system shall be filled from the lowest available point, allowing water to rise and displace air toward system high points. Temporary vent valves, petcocks, and/or manual air vents shall be installed by the Contractor at all high points in the piping system where permanent automatic air vents are not yet in service. Vents shall remain open during filling and shall not be closed until a steady, continuous, bubble-free stream of water is observed at each vent location.
6. Filling shall proceed at a controlled rate sufficient to allow continuous air purging without re-entrainment. Pressurization to the test pressure shall not begin until the Contractor has confirmed and documented that all system high points have been fully vented. Failure to adequately purge air prior to pressurization compromises the validity of the pressure test and may introduce pneumatic stored energy hazards inconsistent with the hydrostatic test method required by this specification.

C. Alternative Test Method (Pneumatic/Compressed Air or Inert Gas)

1. Pneumatic pressure testing using dry compressed air or dry nitrogen shall be permitted only when hydrostatic testing is not feasible. Conditions that may justify use of the pneumatic alternative include:
   a. Ambient temperatures at or below 35°F where freeze protection of the test water cannot be reliably maintained for the required test duration;
   b. Structural limitations of the surrounding system or supporting structure that preclude the imposed load of a full water fill;
   c. Inability to supply or dispose of the required water volume at the project site, documented by the Contractor in writing, and accepted by the Engineer prior to testing.
2. Use of pneumatic testing as a convenience substitute for hydrostatic testing, or to compress the testing schedule, will not constitute a valid justification. Written acceptance by the Engineer is required before the pneumatic method may be substituted for the hydrostatic method on any piping segment.
3. Where pneumatic testing is used, the following safeguards shall apply in addition to the pipe manufacturer's requirements:
   a. A preliminary leak check shall be performed at a pressure not exceeding 25 psi. The Contractor shall inspect all joints and connections for leakage before proceeding to the full test pressure.
   b. A pressure relief device set at no more than 110% of the pneumatic test pressure shall be installed and shall remain in service for the duration of the test.
   c. Personnel shall not be permitted within the immediate test zone during pressurization to full test pressure. The Contractor shall establish and enforce an exclusion zone appropriate for the stored energy of the pressurized system.
   d. The pneumatic test pressure shall not exceed the lower of the maximum pneumatic test pressure permitted by the pipe manufacturer's published testing procedures, or 100 psi, unless a higher pressure is specifically approved in writing by the Engineer.
4. Dry nitrogen is the preferred medium for pneumatic testing. Dry nitrogen eliminates the risk of moisture introduction into the system from compressor carryover, which is a particular concern for systems that will be backfilled and are not readily accessible following installation.

3.3 TESTING OF PIPING

A. Test piping in accordance with the following schedule. There shall be no loss in pressure and no visible leaks after a minimum duration of four hours at the test pressures indicated.

System Tested	Test Pressure	Test With
Chilled Water Piping, Heating Water Piping (250°F & Under), and Heat Pump Loop Water Piping	150 psi at rough-in and 100 psi after equipment connection	Water

3.4 INSTALLATION OF HANGERS AND SUPPORTS FOR PIPING SYSTEMS

A. See Specification Section 230530 (Hangers and Supports for HVAC Piping, Ductwork, and Equipment). Where special hanging or support of ductwork or piping is detailed or shown on the drawings, the drawings shall be followed.

3.5 FLUSHING, CLEANING, AND TREATING HYDRONIC PIPING SYSTEMS AND EQUIPMENT

A. System Preparation

1. The piping system shall be complete prior to flushing, cleaning, and treating.
2. Place all manual valves, pressure regulating valves, and control valves in the open position during flushing and cleaning so that circulation through the entire system is accomplished.
3. Provide temporary pumps when indicated on the drawings and/or when necessary to protect the new pumps from contamination/debris in an existing piping system.

B. Flushing, Cleaning, and Treatment Sequence

1. The flushing, cleaning, and treatment procedures shall be scheduled in advance with the Engineer, Owner, and Commissioning Agent to allow for observation/witnessing as deemed appropriate. See Section 232500 (Chemical Treatment) for chemical treatment requirements.
2. On projects with distribution to/from a ground source bore field, the ground loop piping shall be flushed and cleaned prior to connecting the ground loop to the piping inside the building. See Specification Section 239920 (Ground Loop Flushing and Purging) for additional requirements.
3. Initial Flush
   a. 1st Filling: Completely fill the entire system with fresh water and circulate at approximately 5 feet per second (velocity in the main piping) for a minimum of 4 hours.
   b. The initial flush shall be sufficient to remove all contaminants such as cuttings, filings, loose rust and scale, welding and soldering residue and debris.
   c. 2nd Filling: Drain the entire system and refill with fresh water.
4. Cleaning Flush
   1. Add a concentrated chemical cleaner to the piping system. Cleaner shall be a solution consisting of 2 lbs trisodium phosphate for each 1,000 lbs of water contained in the system. Test the solution for proper concentration and document the results.
   2. Circulate the trisodium phosphate solution at approximately 5 feet per second (velocity in the main piping) for a minimum of 2 hours.
   3. Completely drain the entire system.
5. 3rd Filling: Refill the entire system with fresh water. With the circulation pump(s) running, open drain(s) as far downstream as possible from the fill point. Ensure that the make-up water is sufficient to keep up with the draining to maintain a full system.
   a. Blow down all strainers, dead legs, and low points in the system.
   b. Continue to flush the system in this manner until the drain water is of the same clarity as the make-up water and testing reveals no further traces of cleaning solution (flush for a minimum of 1 hour). Document the results.
   c. Following the fresh water flush, drain the entire system.
   d. Remove, clean, and reinstall all strainer screens, and then fill and treat the entire system. Log photos of the before and after condition of all strainer screens in the system and submit the photos to the Engineer and Owner.

3.6 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.7 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.8 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 21 15 - COPPER PIPING WITH PRESS FITTINGS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

B. Section 232100 (Hydronic Piping and Accessories) is hereby made a part of this section.

1.2 REFERENCE STANDARDS

A. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings

B. ASTM B75 - Standard Specification for Seamless Copper Tube

C. ASTM B88 - Standard Specification for Seamless Copper Water Tube

D. ASTM F3226 - Standard Specification for Metallic Press-Connect Fittings for Piping & Tubing

E. IAPMO PS 117 - Press and Nail Connections

F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials

1.3 SEISMIC COMPLIANCE

A. All press fittings shall have seismic certification complying with IBC Section 1705.13.2/3. Certification shall be in accordance with the ICC Evaluation Service Seismic Certification (AC156), or approved equal.

1.4 QUALITY ASSURANCE

A. Installer Qualifications

1. Installers shall attend a manufacturer’s installation training class and be certified as having been trained and qualified to join piping with press-connect fittings. On-site training and credentialing by a manufacturer’s representative is acceptable.
2. Installers shall be qualified, trained, and certified in the installation of press-connect fittings.
3. Press-connect fittings shall be installed using proper tools, actuators, jaws, and rings as approved by the manufacturer.

1.5 WARRANTY

A. The warranty period for Viega ProPress fittings shall be 50 years from the date of installation, and shall cover any labor and material costs caused by failure of a properly installed fitting.

1.6 SUBMITTALS

A. Submittals shall include information indicating all press fittings, all press tools, and copies of the training certifications for all individuals that are planned to install press fittings on the project.

PART 2 - PRODUCTS

2.1 GENERAL

A. Copper piping with press fittings shall be utilized only when and where specifically identified on the drawings and shall be limited to a maximum pipe size of 2 inches.

2.2 VIEGA PROPRESS PIPE AND FITTINGS

A. Viega ProPress Copper and Cast Copper Alloy Press-Connect Fittings
   1. Viega Press-Connect Fittings are approved for use with copper tubing conforming to ASTM B88 or B75. See Specification Section 232100 (Hydronic Piping and Accessories) for acceptable pipe materials.
   2. Conform to ASME B16.51, ASTM F3226, IAPMO PS-117, NSF 61, and NSF 372. Copper alloy fittings shall be zero lead silicon bronze alloy C87710 (cast) or C88700 (machined). Bismuth bronze or yellow brass fittings are not acceptable.
   3. Sealing elements shall be uniform in size and thickness, and shall be free from manufactured deformities and/or indentations.
      a. Sealing elements for installations designed for water temperatures of 200°F and below shall have peroxide-cured EPDM elastomeric sealing elements rated for 300 psi and a temperature range rating of 0°F through 250°F.
      b. Sealing elements for installations designed for water temperatures above 200°F and/or with a propylene glycol concentration of 50% or above shall have Fluoroelastomer (FKM) or Viton sealing elements rated for 300 psi and a temperature rating range of 14°F through 284°F.
   4. Press-Connect fittings shall have the ‘Viega Smart Connect’ feature integral to the fitting body to detect unpressed fittings during the testing process.
   5. Provide color coded markings on exterior of fitting for readily identifying/inspecting sealing element type.
   6. Approved Fitting Manufacturer: Viega (no exceptions).

B. Approved Tool Manufacturers for Installation of Press-Connect Fittings
   1. Viega, Milwaukee, and/or Rigid.

2.3 VIEGA PROPRESS VALVES

A. Viega ProPress ball valves, butterfly valves, and check valves are acceptable when shown on the drawings. All valves shall be appropriate for the system in which they are installed.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Join copper tube and press-connect fittings with tools recommended by the fitting manufacturer. The manufacturer’s installation instructions shall be strictly adhered to.
   1. All connections shall bear full insertion marks on the tubing.
   2. Special attention shall be given to the required two step pressure test.
   3. Perform an initial ‘Viega Smart Connect’ test for unpressed fitting detection per the manufacturer’s installation manual.
   4. The installer shall use an indelible marker to place their initials on the copper pipe immediately adjacent to each completed press fitting, prior to any insulation being installed.
   5. Training certificates for any individual installing press fittings shall be available on site for review by the Engineer and/or Owner.

3.2 TESTING OF PIPING

A. Test piping at completion of roughing in, in accordance with the following schedule, and show no loss in pressure or visible leaks after a minimum duration of four hours at the test pressures indicated.

TEST SCHEDULE

Systems Tested	
Chilled Water Piping	
Heating Water Piping (250°F and under)	
Heat Pump Loop Water Piping	
Test Pressure	**Test Medium**
150 psi at rough-in	Water
100 psi after equipment connection	Water

3.3 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.4 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.5 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 24 00 - REFRIGERANT PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Refrigerant piping and accessories as indicated on the drawings and as specified herein.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for refrigerant piping systems.

1.4 QUALITY ASSURANCE

A. Flammable refrigerant piping systems shall be installed and tested in strict accordance with ASHRAE Standard 15, including Sections 9.12 (Refrigerant Systems Installation) and 9.13 (Refrigerant Systems Testing).

B. For all flammable refrigerant systems containing 55 lbs or more of refrigerant, the installing contractor shall submit a certificate to the Architect/Engineer and the Owner verifying that the required strength testing and leakage testing has been successfully performed as described in ASHRAE Standard 15 Section 9.13 (Refrigerant Systems Testing).

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING REQUIREMENTS

A. Refrigerant Piping: Type ACR-L hard drawn copper refrigerant tubing with wrought copper solder joint fittings. All joints shall be brazed. Soft drawn copper line sets are not acceptable.

B. Piping Components: The following refrigerant piping components shall be provided.

1. Condensing Unit Service Valves (if not provided integral to the condensing unit by the condensing unit manufacturer (Emerson BV Series, Henry 907 Series, or approved equal).
2. Sight Glass (Emerson HMI Series, Henry MI Series, or approved equal). Sight glasses are not required on mini-split heat pumps and variable refrigerant systems).
3. Filter-Drier (Emerson EK Series, Henry SDM Series, or approved equal). Filter-driers are not required on mini-split heat pumps and variable refrigerant systems).

2.2 REFRIGERANT PIPING INSULATION

A. See Specification Section 230700 (HVAC Insulation).

PART 3 - EXECUTION

3.1 INSTALLATION OF REFRIGERANT PIPING

A. Furnish and install all interconnecting refrigerant piping as shown and/or required. Piping shall be sized in accordance with the equipment manufacturer's recommendations. Pitch suction piping down in the direction of flow.

B. Test all refrigerant piping for leaks with an electronic leak detector.

C. Seal and flash all roof and wall penetrations. Provide metal or plastic pipe shields between insulated refrigerant piping and hangers.

D. Install refrigerant piping and refrigerant-containing components in accordance with ASHRAE Standard 15 and ASME B31.5
   1. Install piping as short as possible, with a minimum number of joints, elbows, and fittings.
   2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 1 inch minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation.
   3. Install condensing unit isolation valves whenever they are not included integral to the condensing unit.
   4. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally, locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing.
   5. Use copper tubing in protective conduit when installed below ground.
   6. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's recommendations.

E. Joint Construction
   1. Brazed Joints: Comply with AWS Brazing Handbook and with filler materials complying with AWS A5.8/A5.8M.
   2. Use Type BcuP copper-phosphorus alloy for joining copper socket fittings with copper tubing.
   3. Use Type BAg cadmium-free silver alloy for joining copper with bronze or steel.
   4. Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.
   5. Pass nitrogen gas through the copper piping to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

F. Protect refrigerant system during construction against entrance of foreign matter, dirt, and moisture; having open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.

G. Pipe refrigerant relief valve discharge to outdoors for systems containing more than 100 lbs of refrigerant.

3.2 REFRIGERANT SYSTEM PRESSURE TESTING, EVACUATION, AND CHARGING

A. Refrigerant system pressure testing, evacuation, and charging procedures shall be performed in the presence of the Owner's representative and/or the Engineer after the refrigerant piping system installation is complete.

B. Prior to evacuation and charging, the refrigerant system shall be pressure tested with nitrogen per the equipment manufacturer’s written recommendations for test pressure(s). Pressure testing shall be conducted when the ambient temperature is relatively stable and shall hold for a minimum of 4 hours without a drop in pressure.

C. Utilize properly sized vacuum pump(s) for refrigerant system evacuation. The refrigerant system compressor shall not be utilized to evacuate the system, nor operated at any time prior to completing the specified triple evacuation procedure. Conduct evacuation and charging procedures at ambient temperatures of 60°F or above whenever practical. If ambient temperatures are consistently below 60°F, contact the Owner and/or the Engineer immediately for approval to proceed or for alternative direction.

D. The first evacuation shall be to 1,000 microns, holding at 1,000 microns for a minimum of two hours. Break the vacuum with either nitrogen or refrigerant.

E. The second evacuation shall be to 750 microns, holding at 750 microns for a minimum of two hours. Break the vacuum with either nitrogen or refrigerant.

F. The third evacuation shall be to 500 microns, holding at 500 microns for a minimum of two hours. Break the vacuum with either nitrogen or refrigerant.

G. After testing, fully charge each system with refrigerant and then conduct a leak test of the entire system with an electronic leak detector.

3.3 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 31 00 - HVAC DUCTWORK

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of ductwork specified in this section include the following:

Sheet Metal Ductwork
Flexible Ductwork
Internally Lined Ductwork
Externally Insulated Ductwork

1.3 QUALITY ASSURANCE

A. Installer: A firm with at least three years of successful installation experience on projects similar to that required for this work.

B. IECC Compliance: Comply with applicable portions of the International Energy Conservation Code, including, but not limited to Section C403.13.

C. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) recommendations for all work in this section.

D. ASHRAE Standards: Comply with applicable portions of American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommendations for all work in this section.

E. NFPA Standards: Comply with applicable portions of ANSI/NFPA Standard 90A (Standard for the Installation of Air Conditioning and Ventilating Systems) and ANSI/NFPA 90B (Standard for the Installation of Warm Air Heating and Air Conditioning Systems) for all work in this section.

F. NAIMA Standards: Comply with all applicable portions of the North American Insulation Manufacturers Association (NAIMA) standards for all related work in this section.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on manufactured products and factory fabricated ductwork used for the work of this section.

B. As-Built Drawings: At project closeout, submit as-built drawings of installed ductwork, duct accessories, outlets, and inlets.

PART 2 - PRODUCTS

2.1 GENERAL

A. All duct dimensions shown on the drawings are the net clear inside dimensions.

B. All duct insulation thicknesses and conductivities shall meet or exceed the requirements listed in International Energy Conservation Code Section C403.13. All conductivity values listed in this specification section are in Btu-in/(hr-ft^2-°F).

C. Fabricate all ductwork using a commercial grade of galvanized steel complying with the SMACNA HVAC Duct Construction Standards (latest edition) for the specified duct pressure class.

D. Fabricate ductwork with all accessories installed during fabrication to the greatest extent possible. Refer to Specification Section 233110 (HVAC Ductwork Accessories) for accessory requirements.

E. See Specification Section 230700 (Insulation for HVAC Systems) for additional requirements.

F. All ductwork shall be constructed and sealed in accordance with the requirements of the Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) unless indicated otherwise herein.

G. Construct and seal all ductwork in accordance with the pressure related to the equipment or system to which it is connected unless indicated otherwise herein. See Section 3.1 of this specification for additional requirements and clarification.

H. Ductwork upstream of terminal units shall be 4” w.c. pressure class and ductwork downstream of terminal units shall be 2” w.c. pressure class.

I. Wherever ductwork is to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.

J. Wherever ductwork is to be exposed to view in occupied spaces and is indicated to be painted, that ductwork shall be fabricated using a commercial grade of phosphatized, galvannealed, or bonderized sheet metal that is specifically formulated for painting.

K. Duct fittings shall be constructed to match the adjoining ductwork and to comply with all duct requirements applicable to fittings. See ‘Typical Branch Ducts’ details on the drawings for acceptable fitting types.

L. Turning Vanes in Rectangular Duct Elbows: Turning vanes shall be provided in all rectangular duct elbows unless indicated otherwise on the drawings, such as in return air transfer ducts, where turning vanes shall not be installed. All turning vanes shall be SMACNA ‘Large’ (R=4.5”/SP=3.25”). Turning vanes in medium pressure ducts (3.0“ w.c. or greater) shall be double thickness. Turning vanes in low pressure ducts (2.0“ w.c. or less) with duct widths 30 inches and smaller shall be single thickness. Turning vanes in low pressure ducts (2.0“ w.c. or less) with duct widths 32 inches and larger shall be double thickness.

M. Except as otherwise indicated, or where a reaction between dissimilar metals might occur, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim, and angles for support of all ductwork. Utilize Unistrut channel supports and hangers as appropriate for larger duct sizes. Penetrating ductwork with screws shall be avoided to the greatest extent possible. Wherever screws are required to penetrate ductwork the penetrations shall be sealed air and water tight.

2.2 TWO INCH PRESSURE CLASS DUCTWORK

A. Rectangular ductwork shall be fabricated using a commercial grade of galvanized steel complying with the SMACNA HVAC Duct Construction Standards (latest edition) for the specified duct pressure class. Ductwork and fitting gauges shall be in accordance with Chapter 2 of the SMACNA HVAC Duct Construction Standards (latest edition).

B. Round ductwork shall be spiral lock seam round and/or oval duct and fittings.

2.3 ROUND AND OVAL DUCTWORK

A. Round and Oval Ductwork: Provide spiral lock seam pre-fabricated duct, constructed and sealed for 4 inch pressure class. The requirement for spiral lock seam round and oval ducts also applies to 2 inch pressure class round and oval ductwork. Longitudinal seam round or oval ductwork is not acceptable.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory fabricated ductwork which may be incorporated in the work include the following, or approved equal:

Manufacturer
McGill Airflow Uni-Seal
Semco
OmniDuct
Air Handling Systems

C. Spiral lock seam prefabricated factory-built round and oval duct and fittings shall be used wherever possible. Shop fabricated ducts shall be used only where rectangular shaped ducts are shown on the drawings or where transitions and special fittings cannot be prefabricated by the factory.

D. Optional Shop Fabricated Ductwork and Fittings: As an alternative to factory fabricated ductwork, the Contractor may shop fabricate the spiral seam ductwork provided that certification is submitted and approved indicating that the shop fabricated ductwork and fittings are equal to that specified for factory fabricated ductwork and fittings.

E. Shop fabricate ductwork in 4, 8, 10, or 12 foot lengths, unless otherwise indicated or required, to complete duct runs. Pre-assemble ductwork in the shop to the greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to the extent necessary for shipping and handling. Match and mark duct sections for reassembly and for a coordinated installation.

F. Round and Oval Fittings: The following round duct fittings shall be used, in accordance with what is depicted on the drawings.

1. All round fittings shall be full bodied type.
2. Round elbows shall be constructed with a 1.5 radius to diameter (R/D) ratio.
3. Round elbows shall be segmented/gored type, constructed in accordance with the current SMACNA Duct Construction Standards. Adjustable elbows are not acceptable.
4. Low loss conical tees, conical laterals, reducing tees, and 90° crosses.
5. Reducers and increasers shall be constructed for a maximum angle of 30 degrees.
6. Spin-in and/or tap-type fittings that require field cuts into the ductwork are not acceptable.
7. No exceptions will be allowed to the listed fitting requirements.

G. Concealed Round and Oval Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A653, in conformance with the listed manufacturing method, and in the listed minimum duct and fitting gauge.

Diameter	Minimum Duct Gauge	Minimum Fitting Gauge	Manufacturing Method
3" to 14"	28	28	Spiral Lockseam
16" to 24"	26	26	Spiral Lockseam
26" to 42"	24	24	Spiral Lockseam
44" to 60"	22	22	Spiral Lockseam
62" to 96"	20	20	Spiral Lockseam

H. Exposed Round and Oval Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A653, in conformance with the listed manufacturing method, and in the listed minimum gauge. Note that exposed round and oval ductwork is required to be heavier gauge than concealed round ductwork so that potential damage or denting is less likely.

Diameter	Minimum Duct Gauge	Minimum Fitting Gauge	Manufacturing Method
3" to 14"	26	26	Spiral Lockseam
16" to 24"	24	24	Spiral Lockseam
26" to 42"	22	22	Spiral Lockseam
44" to 60"	20	20	Spiral Lockseam
62" to 96"	18	18	Spiral Lockseam

I. Identification of Round and Oval Ductwork and Fittings: To allow for field verification of the appropriate gauge material, round duct and fitting factory labels shall be visible from the floor such that they can be observed prior to insulating.

2.4 HANGERS AND SUPPORTS FOR DUCTWORK

A. See Section 230530 (Hangers and Supports for HVAC Systems)

2.5 SEISMIC BRACING FOR DUCTWORK

A. See Section 230540 (Seismic Bracing for HVAC Systems)

2.6 DUCT ACCESS DOORS

A. See Specification Section 233110 (HVAC Ductwork Accessories).

2.7 DUCTWORK INSULATION

A. All 4 inch pressure class rectangular and round supply, return, and outside air ductwork shall be externally insulated unless specifically indicated otherwise in these specifications or on the drawings. See Specification Section 230700 (Insulation for HVAC Systems) for associated requirements.

B. All 2 inch pressure class rectangular and round supply, return, and outside air ductwork shall be externally insulated unless specifically indicated otherwise in these specifications or on the drawings. See Specification Section 230700 (Insulation for HVAC Systems) for associated requirements.

C. Internal Duct Liner Insulation

1. Internal duct liner at transfer ducts shall be 1” thick Johns Manville Linacoustic R-300 Duct Liner, or approved equal, with an insulating value of R-6.3 and a 25/50 flame and smoke spread rating in accordance with ASTM E84.
2. Internal duct liner indicated elsewhere on the drawings shall be 1-1/2” thick Johns Manville Linacoustic R-300 Duct Liner, or approved equal, with an insulating value of R-6.3 and a 25/50 flame and smoke spread rating in accordance with ASTM E84.
3. Cut and adhere internal duct liner, and seal all fiberglass edges in strict accordance with the duct liner manufacturer’s written application instructions.
4. Additionally secure duct liner with weld pins or with Duro-Dyne PBH Dynastick Fasteners adhered with Duro-Dyne PBACZVOC Dynastick Adhesive. Fastener spacing shall be in accordance with the insulation manufacturer’s written instructions.
5. Adjust all duct sizes shown on the drawings to accommodate the liner thickness, and provide the net internal duct dimensions shown on the drawings.
6. For internal duct liner at terminal units (vav boxes) see Specification Section 23 36 00 Terminal Units (VAV Boxes).

2.8 MISCELLANEOUS DUCTWORK MATERIALS

A. Provide miscellaneous materials and products of types and sizes indicated, unless otherwise indicated. Provide per the requirements listed in the latest SMACNA manuals, including proper connection of ductwork and equipment.

B. Duct Joints: Join and seal prefabricated, factory built ducts, fittings, and couplings in strict accordance with duct manufacturer's instructions. Install duct sealers, pop rivets, or sheet metal screws, canvas, and lagging adhesive on each joint. Duct sealer shall be fire retardant. Sheet metal screws for joints shall be minimum #10 size galvanized.

2.9 SEALANTS

A. Duct sealant shall be water-based, non-fibrated, and fire resistive with a UL 181B listing for use on low, medium, and high pressure ductwork. Sealant VOC levels shall also meet all federal, state, and local requirements and be classified with mildew resistance per ASTM G21 with 0 growth rating.

B. Sealant shall be rated for up to 10" w.c. and shall be installed in strict accordance with the manufacturer's written instructions. Pressure sensitive tapes are not acceptable.

C. Subject to compliance with requirements, manufacturers offering sealants which may be incorporated in the work include the following:

Design Polymerics DP-1010
Hardcast Iron-Grip 601
Foster 32-19
Childers CP-146

2.10 FLEXIBLE DUCTS

A. Flexible ducts may be used in concealed areas where detailed and as specified.

B. Flexible ducts shall consist of an exterior reinforced laminated vapor barrier, 2 inch thick fiberglass insulation (R-6), encapsulated spring steel wire helix, and impervious, smooth, non-perforated interior vinyl liner. Each individual length of flexible duct shall include factory fabricated steel connection collars. Flexible ducts shall be UL approved and tested and shall meet Class 1 requirements of NFPA 90A.

C. Flexible ducts from rigid runouts to diffusers and registers shall be Thermaflex M-KE, or approved equal, with a maximum length of 5 feet.

D. Comply with all applicable portions of the Air Duct Council Flexible Duct Performance and Installation Standards.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

A. Assemble and install ductwork to achieve air tight and noise-free (no objectionable noise) systems capable of performing each indicated service.

B. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling.

C. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.

D. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.

E. Support ductwork and piping in a manner complying with Section 230530 (Hangers and Supports for HVAC Piping and Equipment). Where special hanging of ductwork or piping is detailed or shown on drawings, the drawings shall be followed.

F. Duct hangers used in areas where a specialty architectural ceiling or floor occurs shall be compatible for use with that system. See architectural and structural drawings for locations.

G. Seal all ductwork to the seal class required in the following table, and using the methods prescribed in the SMACNA HVAC Air Duct Leakage Test Manual, latest edition.

Duct Class	Up to 2” w.c.	3” w.c.	4” thru 10” w.c. and/or exposed to weather
Seal Class	C	B	A
Sealing	Transverse Joints Only	Transverse Joints and Seams	Joints, Seams, and all Applicable Wall Penetrations
Leakage Class			
Rectangular Metal	16	8	4
Round Metal	8	4	2

1. Sealant shall be applied 3 inches wide and at 32 mil wet film thickness.
2. For ducts greater than 2” pressure class, or exposed to weather, a first layer of sealant shall be applied to an 18 mil thickness, with scrim applied over the sealant, and then another 18 mil thickness of sealant shall be applied over the scrim.

3.2 INSTALLATION OF FLEXIBLE DUCTWORK

A. Provide supports at or near the mid-length point using 2 inch wide 28 gauge steel hanger collars attached to the structure with an approved duct hanger. Installation shall eliminate sharp radius turns, offsets, or kinks.

B. Bends in flexible ductwork shall be kept to a minimum. The minimum bend radius shall be 1.5 times the duct diameter with no bends greater than 45 degrees. This specifications and any applicable drawings or details shall be strictly adhered to.

C. Each length of flexible duct shall be provided with steel connection collars.

D. Make connections to rigid duct and equipment with draw bands and sealer, and then apply duct tape over outside of sheath.

3.3 CLEANING AND PROTECTION OF DUCTWORK

A. Clean ductwork internally, unit by unit as it is installed, of any dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or where ductwork is to be painted.

B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at the time of ductwork installation, provide temporary closure using polyethylene film or other covering which will prevent entrance of dust and debris until the time that connections are to be completed.

3.4 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, and tools, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 31 10 - HVAC DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of ductwork accessories specified in this section include volume dampers, control dampers, fire-smoke dampers, turning vanes, duct hardware, duct access doors, flexible connections, and backdraft dampers.

1.3 QUALITY ASSURANCE

A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC Duct Construction Standards (Metal and Flexible) latest edition, for all work in this section.

B. ASHRAE Standards: Comply with American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommendations, latest edition, for all work in this section.

C. NFPA Compliance: Comply with ANSI/NFPA 90A (Standard for the Installation of Air Conditioning and Ventilating Systems) and ANSI/NFPA 90B (Standard for the Installation of Warm Air Heating and Air Conditioning Systems).

D. Compliance: Construct, test, install and label fire dampers and fire doors in accordance with Underwriters Laboratories (UL) Standard 555 (Fire Dampers and Ceiling Dampers).

E. Dampers shall be warranted against manufacturing defects for a period of 5 years.

F. Dampers shall be tested, rated and labeled in accordance with the latest requirements of UL 555 (Fire Dampers) and UL 555S (Smoke Dampers).

G. Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA 500.

H. Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA 500 and certified in accordance with AMCA 500D.

1.4 REFERENCES

AMCA 500D	Laboratory Test Methods for Testing Dampers for Ratings
AMCA 511	Certified Ratings Program for Air Control Devices
IBC	International Building Code
NFPA 80	Fire Doors and Other Opening Protectives
NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	Standard for the Installation of Warm Air Heating and Air Conditioning Systems
NFPA 92A	Smoke Control Systems
NFPA 101	Life Safety Code
NFPA 105	Standard for the Installation of Smoke Door Assemblies
UL 555	Standard for Safety; Fire Dampers
UL 555S	Standard for Safety; Smoke Dampers

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction, and installation instructions.

B. Fire-Smoke Dampers: Submit complete installation instructions for all types of fire damper to be used on this project, as part of main submittal.

PART 2 - PRODUCTS

2.1 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA HVAC Duct Construction Standards, latest edition.

B. Turning Vanes in Rectangular Duct Elbows: Turning vanes shall be provided in all rectangular duct elbows unless indicated otherwise on the drawings, such as in return air transfer ducts, where turning vanes shall not be installed. All turning vanes shall be SMACNA 'Large' (R=4.5"/SP=3.25"). Turning vanes in medium pressure ducts (3.0" w.c. or greater) shall be double thickness. Turning vanes in low pressure ducts (2.0" w.c. or less) with duct widths 30 inches and smaller shall be single thickness. Turning vanes in low pressure ducts (2.0" w.c. or less) with duct widths 32 inches and larger shall be double thickness.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering turning vanes which may be incorporated in the work include the following, or approved equal:

Anemostat
Airsan Corporation

2.2 DUCT HARDWARE

A. Provide duct hardware manufactured by one manufacturer for all items on project for the following:

1. Test Holes: Provide in ductwork at fan inlet and outlet and elsewhere as required. Plastic test plugs may only be used on low pressure ductwork (2" w.c. or less). Test holes installed in medium pressure ductwork (above 2" w.c.) and at outdoor equipment shall be covered with Ventlok Model 699 covers, or approved equal.
2. Quadrant Locks: Provide for each damper quadrant lock device on one end of shaft and end-bearing plate on other end. Provide extended quadrant locks and extended bearing plates for externally insulated ductwork.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct hardware which may be incorporated in the work include the following, or approved equal:

Ventfabrics
Ventlok by Ventfabrics

2.3 DUCT ACCESS DOORS

A. Provide airtight access doors in ducts and plenums for cleaning and repairs of fire dampers, control devices, etc. and where shown on the drawings. Access door size shall be duct width by duct height for all ducts under 24 inches. Minimum access door size shall be 8 inches by 8 inches. Ducts over 24 inches in diameter shall have 24 inch by 18 inch access doors.

B. Access doors shall be rated for the associated duct pressure (positive or negative).

C. Access doors in supply air and return air ducts shall be insulated as required to provide a minimum R-6.0 rating. Insulation shall be 25/50 rated in accordance with ASTM E84. Access doors in supply air and return air ducts shall be Ductmate Model FD, or approved equal.

D. Access doors in low pressure ductwork (3.0” w.c. and below) shall be hinged with cam latches, and a perimeter gasket.

E. Access doors in medium pressure ductwork (4.0” w.c. and above) shall be constructed with cam latches and a perimeter gasket.

F. Access doors in stainless steel ductwork shall be constructed of stainless steel.

G. Access doors in grease exhaust ducts shall be UL listed, shall be Ductmate Ultimate, or approved equal.

H. Access doors shall be permanently identified on the exterior by a permanent label with letters not less than 1/2 inch in height reading ‘Fire-Smoke Damper’ or as otherwise appropriate.

I. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct access doors which may be incorporated in the work include the following, or approved equal:

Ductmate
Best Access Doors
United McGill

2.4 FLEXIBLE CONNECTIONS

A. Furnish and install flexible connections at following locations:

At supply connection on all motorized heating and cooling equipment.
At return connection on all motorized heating and cooling equipment.
At duct connection on all exhaust fans.
Elsewhere as shown on the drawings.

B. Flexible connections are not required for curb-mounted or roof-mounted exhaust fans.

C. Flexible duct connections shall be preassembled flexible connectors constructed of coated glass fabric applied in accordance with manufacturer's recommendations. Width of flexible connections shall be sufficient to allow minimum of 2 inches of free space between two metal collars to be connected. Install sheet metal band completely around duct or fan outlet, at end of flexible connection. Fasten with metal screws through band and coated glass fabric. Space screws approximately 3 inches apart. Coated glass fabric shall be equal to Ventfabrics Ventglas with neoprene coating for use inside building and Ventlon with hypalon coating when exposed to weather.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering flexible connections which may be incorporated in the work include the following:

Ventfabrics
Thermaflex

2.5 DAMPERS (MANUAL, REMOTE POWERED, CONTROL, AND BACKDRAFT DAMPERS)

A. Manual Dampers: Provide manual volume dampers in all locations shown on the drawings. Dampers shall be single blade type or multi-blade type, constructed in accordance with the SMACNA HVAC Duct Construction Standards, latest edition. Round dampers shall be Greenheck Model MBDR-50, or approved equal. Rectangular dampers shall be Greenheck Model MBD-15, or approved equal. Shop-fabricated dampers are not acceptable.

B. Concealed Damper Actuators: Where dampers are installed above non-accessible ceilings and are not served by access doors, provide extension cables and concealed ceiling mounted damper regulators. Damper regulator shall be Young Regulator Model 270-896, or approved equal.

C. Remote Powered Balancing Dampers: Where indicated on the drawings, provide remote powered balancing dampers complete with motorized damper, connecting cable, and wall or ceiling plate with number of ports as indicated on the drawings. Dampers shall be Greenheck Model RBDR-50, Pottorff Model RD-10R, Young Regulator Model EBD, or approved equal.

D. Control Dampers: Provide dampers with low leakage opposed blades, frame and blades constructed of 16 gauge galvanized steel, suitable for electric actuators.

E. Backdraft Dampers: Provide dampers with parallel blades, constructed of 16 gauge aluminum; provide 1/2 inch diameter ball bearings, 1/2 inch diameter steel axles spaced on 9 inch centers. Construct frame of 2” x 1/2” x 1/8” thick steel channel for face areas 25 sf and under; and 4” x 1-1/4” x 16 gauge channel for face areas over 25 sf. Provide galvanized steel finish on frame with aluminum touch-up.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dampers which may be incorporated in the work include the following, or approved equal:

Greenheck
Pottorff
Young Regulator
Ruskin
Ruskin Model FSD-60

2.6 DUCT SMOKE DETECTORS

A. Duct smoke detectors shall be installed at the locations shown on the drawings, as listed in the equipment schedules, and as described herein.

B. Duct smoke detectors shall be furnished by Division 26. Installation of duct smoke detectors and wiring between duct smoke detectors and the associated mechanical equipment shall be by Division 23. Electrical power to duct smoke detectors and wiring to the fire alarm control panel shall be by Division 26.

C. It is the mechanical contractor’s responsibility to ensure that their bid includes a complete installation that is coordinated with the duct smoke detectors, equipment, and all applicable code requirements.

D. Duct smoke detectors shall be installed in conformance with Uniform Mechanical Code Section 608. Equipment that has a scheduled airflow in excess of 2,000 cfm shall have a duct smoke detector installed in both the supply air and the return air.

E. Equipment that has a scheduled airflow in excess of 15,000 cfm and serves multiple floors of a building shall have duct smoke detectors installed in the return air duct where the return air exits each floor of the building (prior to the main return air riser) in addition to the supply air duct smoke detector(s) specified in this section.

F. In cases where there are no Division 26 plans and specifications, duct smoke detectors shall be furnished and installed by Division 23. Such duct smoke detectors shall be manufactured by Edwards, Notifier, or approved equal. On projects where duct smoke detectors will be connected to an existing fire alarm system, the new duct detectors shall match the existing system manufacturer’s devices. Duct smoke detectors shall include dual auxiliary contacts for interface with the fire alarm system and the direct digital control system.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCT ACCESSORIES

A. Install duct accessories in accordance with the manufacturer's installation instructions, with applicable portions of details of construction as shown in the SMACNA Standards, and in accordance with recognized industry practices as necessary to ensure that the products serve the intended function.

B. Install turning vanes in square and/or rectangular 90 degree elbows in supply and exhaust air systems and elsewhere as indicated.

C. Install access doors to open against system air pressure, with latches operable from either side, except on the outside only where the duct is too small for a person to enter.

D. Coordinate with other work as necessary to interface installation of duct accessories properly with other work.

E. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories as required to obtain proper operation and leak-proof performance.

3.2 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to the Architect/Engineer. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.3 INSPECTION OF FIRE-SMOKE DAMPERS

A. Upon completion of this work all fire-smoke dampers shall be tested by the installing contractor in the presence of the local fire department. Provide spare fusible links as required to complete testing to the complete satisfaction of the local fire department.

3.4 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.5 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 34 00 - HVAC FANS AND HOODS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of fans, hoods, and curbs specified in this section include the following:
   1. Upblast Exhaust Fans
   2. Pre-Fabricated Seismic Roof Curbs
   3. Destratification Fans

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of material listed in this section.

B. Operation and Maintenance Data: Submit operation and maintenance data and replacement material lists for each type of material listed in this section. Include this data and product data in the operation and maintenance manual.

PART 2 - PRODUCTS

2.1 UPBLAST EXHAUST FANS

A. Provide upblast exhaust fans, curb mounted, of type, size, and capacity as scheduled on the drawings, and as specified herein. Fans shall be Greenheck Model CUE, or approved equal.

B. Ratings: Test and rate fans in accordance with ASHRAE Standards. Provide with AMCA Certified Ratings Seal for both airflow and sound.

C. Type: Upblast type, direct drive, or belt drive as scheduled. Provide capacitor-start, induction-run type motor for belt drive fans. Provide an EC motor with a speed control for direct drive fans.

D. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering kitchen exhaust fans which may be incorporated in the work include the following, or approved equal:

   Greenheck
   Cook

2.2 PRE-FABRICATED SEISMIC ROOF CURBS

A. See Specification Section 230500 (Basic Materials and Methods for HVAC).

2.3 DESTRATIFICATION FANS (HIGH VOLUME LOW SPEED FANS)

A. Provide high volume low speed fans of type, size, and capacity as scheduled on the drawings, and as specified herein. Fans shall be Big Ass Fan Powerfoil 8, or approved equal. Furnish with standard controller and BACnet interface card.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high volume low speed fans which may be incorporated in the work include the following, or approved equal:

Big Ass Fans
Greenheck
Cook

PART 3 - EXECUTION

3.1 GENERAL

A. Install fans and ventilators where indicated, in accordance with equipment manufacturer's installation instructions, and with recognized industry practices, to ensure that equipment complies with requirements and serves intended purposes.

B. Provide motors so that they cannot be overloaded above nameplate rating throughout the full speed range of the adjustable pitch driving sheave.

C. Fan wheels shall be balanced statically and dynamically near operating speed.

D. Provide drives and guards conforming to the requirements hereinbefore specified.

E. Fan construction, speed, noise level, tip speeds, outlet velocities, and efficiencies will be taken into consideration in assessment of all fans that are submitted.

3.2 ROOF CURBS

A. Furnish roof curbs to the roofing installer for installation.

3.3 ELECTRICAL CONNECTIONS

A. Ensure air distribution equipment is wired properly, with rotation in direction indicated and intended for proper performance.

3.4 CARE AND CLEANING

A. Repair or replace broken, damaged or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Owner’s representative. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.5 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.6 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like and leave the premises clean, neat and orderly.

END OF SECTION

SECTION 23 35 00 - AIR FILTERS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of air filter, including dimensions, thickness, capacity, and materials of construction.

1.3 CERTIFICATIONS

A. The filter manufacturing facility shall be certified to comply with ISO 9001:2015. Filters shall be listed by Underwriters Laboratories as UL Class 900.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering air filters which may be incorporated in the work include the following, or approved equal:

Camfil
American Air Filter

2.2 MERV 13 PLEATED AIR FILTERS (2” & 4” THICK)

A. General

1. Air filters shall be medium efficiency ASHRAE panel filter type, of size, thickness, and quantity as scheduled on the drawings. Filters shall be Camfil AP-Thirteen, or approved equal.

B. Construction

1. Filters shall be configured into high capacity pleat densities of 15 pleats per linear foot for 2” thick filters, and 11 pleats per linear foot for 4” thick filters. Filter enclosing frame shall be constructed of a 24 point high wet-strength beverage board that is bonded to the media shall provide a rigid and durable enclosure. Filters shall have a welded wire grid, spot-welded on centers, and treated for corrosion resistance, shall be bonded to the downstream side of the media to maintain the radial pleat and prevent media oscillation
2. Filters shall have charged synthetic media, lofted to a uniform depth, and formed into a uniform radial pleat.

C. Performance

1. The filter shall have a Minimum Efficiency Reporting Value (MERV) rating of 13 when evaluated under ASHRAE Standard 52.2.
2. The initial resistance to airflow for 2 inch thick filters shall not exceed 0.38” w.c. at 500 fpm, and 0.30” w.c. at 400 fpm.
3. The initial resistance to airflow for 4 inch thick filters shall not exceed 0.33” w.c. at 500 fpm, and 0.25” w.c. at 400 fpm.
4. The recommended filter change-out resistance is 1.0” w.c.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. This section includes specifications and requirements for air outlets and inlets.

1.3 QUALITY ASSURANCE

A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC Duct Construction Standards (Metal and Flexible), latest edition, for all work in this section.

B. ASHRAE Standards: Comply with American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommendations, latest edition, for all work in this section.

C. NFPA Compliance: Comply with ANSI/NFPA 90A ‘Standard for the Installation of Air Conditioning and Ventilating Systems’, and ANSI/NFPA 90B ‘Standard for the Installation of Warm Air Heating and Air Conditioning Systems’.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction, and installation instructions.

PART 2 - PRODUCTS

2.1 AIR OUTLETS AND INLETS

A. See air distribution schedule on the drawings for outlet and inlet types.

B. Grilles, registers, and diffusers shall be selected and guaranteed by the manufacturer to operate without objectionable noise or draft.

C. Furnish and install sponge rubber gaskets between grilles and grounds of finished surfaces. Wood grounds will be furnished by others. Metal grounds shall be furnished by the Contractor. Sidewall grilles and registers shall be provided with a dull/flat prime coat finish, unless noted otherwise. All supply diffusers, registers, and grilles located at ceilings shall have factory-applied bone white finish, unless indicated otherwise on the drawings.

D. Paint visible ductwork behind grilles, registers, and diffusers flat black.

E. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown of size, shape, capacity, and type indicated; constructed of materials and components as indicated and as required for a complete installation. Provide diffusers with border styles that are compatible with adjacent ceiling systems and that are specifically manufactured to fit into ceiling modules with accurate fit and adequate support. Refer to the architectural drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser and/or grille.

F. Allowable Manufacturers: Subject to compliance with requirements, manufacturers offering air outlets and inlets which may be incorporated in the work include the following, or approved equal:

Price
Krueger
Titus

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR OUTLETS AND INLETS

A. Install outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.

B. Locate ceiling air diffusers, registers, and grilles as indicated on reflected ceiling plans. Unless otherwise indicated, locate units in the center of acoustical ceiling modules.

C. Examine areas and conditions under which outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

D. Ceiling mounted air terminals or services shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.

E. Air terminals or services weighing not more than 56 pounds shall have two 12 gauge hangers connected from the air terminal or service to the structure above. These wires may be slack.

F. Air terminals or services weighing more than 56 pounds shall be supported directly from the structure above using submitted and approved hangers.

3.2 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.3 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.4 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 75 20 - OUTDOOR ROOFTOP HEAT PUMPS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 SUMMARY

A. Furnish and install outdoor rooftop heat pumps with capacities and characteristics as listed on the drawings and in these specifications.

1.3 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and identified with labels describing contents.
   1. Three sets of spare filters for each unit.
   2. One set of spare fan belts.

1.4 WARRANTY

A. The unit manufacturer shall provide a 5 year parts only warranty against defects in material and workmanship on all parts.

B. The Contractor shall provide a 5 year labor warranty.

C. The warranty period shall commence upon acceptance of the operational units by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering heat pumps which may be incorporated in the work include the following or approved equal:

   Daikin

2.2 GENERAL

A. Furnish and install outdoor rooftop heat pumps as indicated on the drawings. Equipment shall be completely assembled, piped, and internally wired. Capacities and characteristics shall be as listed in the schedule on the drawings and in these specifications. The reverse cycle heating/cooling units shall be rooftop type with supply and return air configurations as shown and scheduled on the drawings.

B. Units shall be AHRI/ISO 13256-1 certified and listed by a nationally recognized safety testing laboratory or agency such as the ETL Testing Laboratory. Each unit shall be computer run tested at the factory with conditioned water and operation verified to match catalog data. Each unit shall be mounted on a pallet and shipped in a corrugated box or stretch wrapped. Units shall be designed to operate in cooling mode at outdoor temperatures between 0°F and 125°F, and in heating mode at outdoor temperatures down to -10°F.

2.3 CASING AND CABINET

A. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect the insulation during service and maintenance. Insulation shall be a minimum of 1" thick with a minimum R-value of 7, and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. The unit cabinet shall be designed to operate at total static pressures up to 5 inches w.c.

B. Exterior surfaces shall be constructed of painted galvanized steel. Paint finish shall include a base primer with a high quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.

C. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide service access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

D. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weather-tight seal.

2.4 OUTDOOR/RETURN AIR SECTION

A. Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature setpoint. The outdoor air hood shall be factory installed and constructed from galvanized steel, finished with the same paint finish as the main unit. The hood shall include moisture elimination filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design, and shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm/sf of damper area at a differential pressure of 1” in accordance with AMCA 500 test procedures. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. The exhaust damper blades shall be lined with vinyl gasketing on all contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. The damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for ‘free’ cooling. If outdoor air is suitable for ‘free’ cooling, the outdoor air dampers shall modulate in response to the unit’s integral control system.

B. Low leakage dampers shall be provided. Damper blades shall be fully gasketed, side sealed, and arranged vertically in the hood. Damper leakage shall be less than 1.5 cfm/sf of damper area at 1.0 inch static pressure differential. The leakage rate shall be tested in accordance with AMCA Standard 500. The damper blades shall be operated using multiple sets of linkages mounted on the leaving face of the dampers.

C. Control of the outdoor dampers shall be by a factory-installed actuator. The damper actuator shall be of the modulating type. Damper shall open when the supply fan starts, and close when the supply fan stops.

D. Provide economizer assembly Fault Detection and Diagnostics (FDD) in accordance with ASHRAE Standard 90.1 and IECC requirements.

2.5 SUPPLY FAN

A. The supply fan shall be a single width, single inlet, airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable.

B. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit integral controller. The motor shall include thermal overload protection and shall protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and shall prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency type.

C. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

D. The unit controller shall provide proportional control of the supply fan motor based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within the setpoint and deadband range. The unit controller shall provide discharge air temperature control utilizing compressor modulation.

E. The unit manufacturer shall install all power and control wiring.

F. The supply fan drive output shall be controlled by the factory installed main unit control system. Supply fan drive status and operating speed shall be monitored and displayed at the main unit control panel.

2.6 EXHAUST FAN

A. The exhaust fan shall be a single width, single inlet, airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable.

B. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit integral controller. The motor shall include thermal overload protection and shall protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and shall prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency type.

C. The unit direct digital controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply fan design airflow to maintain the adjustable building static pressure setpoint. The required sensing tubing from the building to the factory mounted building static pressure sensor shall be furnished and field-installed by the Contractor.

D. The exhaust fans shall be direct drive axial type. Blades shall be constructed with fabricated steel and shall be securely attached to the fan shafts. All exhaust fan assemblies shall be statically and dynamically balanced. Motors shall be permanently lubricated, heavy duty type, matched to the fan load. Ground and polished steel fan shafts shall be mounted in permanently lubricated and sealed ball bearings. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at the maximum cataloged operating speeds.

2.7 AIR FILTERS

A. The unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” pre-filter and a 4” final filter. The unit shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2” Merv 8 construction filters. Prior to testing, balancing, and commissioning, the Contractor shall furnish and install a new set of 2” Merv 8 pre-filters and 4” Merv 13 final filters.

2.8 CONDENSING SECTION

B. Outdoor coils shall have seamless copper tubes, mechanically bonded into aluminum plate type fins. The fins shall have full drawn collars to completely cover the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high pressure air under water.

C. Fan motors shall be an ECM type motor for proportional control. The integral unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit in ambient conditions up to 125°F. Mechanical cooling shall be provided at outdoor temperatures down to 0°F. Heat pump heating shall be provided at outdoor temperatures down to -10°F. The motor shall include thermal overload protection and shall protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

D. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. The fan blade shall be constructed of a composite material.

E. The unit shall have an inverter type compressor providing proportional control. The unit integral controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and an oil separator for each compressor that routes oil back to the compressor instead of through the discharge line. Variable capacity compressors, two step compressors, fixed speed compressors, or anything other than a variable speed compressor will not be acceptable.

F. Pressure transducers shall be provided for monitoring the suction and head pressures. Temperature sensors shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. The pressure and temperature sensors shall be an input to the unit controller and the values shall be displayed at the unit controller.

G. The refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for low head pressure compressor starting, and increased compressor reliability. When there is a call for mechanical cooling the bypass valve shall open to equalize the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.

H. Each circuit shall be factory-dehydrated and factory-charged with R-32 refrigerant and oil.

2.9 COOLING COIL

A. The indoor coil section shall be installed in a draw through configuration, upstream of the supply fan. The cooling coil section shall be complete with a factory-piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

B. The direct expansion cooling coils shall be fabricated of seamless copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design, with a minimum of 3 rows. All cooling coils shall have interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. The cooling coil shall have an electronically controlled expansion valve. The integral unit controller shall control the expansion valve to maintain liquid subcooling and superheat of the refrigerant system.

D. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressor(s).

E. The drain pan shall be stainless steel and positively sloped with a minimum slope of 1/8" per foot. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall extend beyond the leaving side of the coil and shall have a threaded drain connection extending through the unit base.

2.10 HEAT PUMP HEATING

A. The evaporator coil, condenser coil, compressors, and refrigerant circuit shall be designed for heat pump operation. The refrigerant circuit shall contain a 4-way reversing valve for heat pump operation. The outdoor coil shall have an electronic expansion valve to control the refrigerant flow. The integral unit controller shall modulate the expansion valve to maintain compressor operation within the compressor operational envelope.

B. The refrigerant system shall have a pump-down cycle.

C. The heat pump shall use a compressor boost sequence to allow the compressor speed to increase as the ambient temperature goes down, until the compressor reaches the maximum speed, maximizing the heating capacity at lower ambient temperatures.

D. To maximize heating capacity and avoid damaging the condenser fan, the heat pump shall utilize a defrost-on-demand sequence that determines when the unit needs to go into defrost based on leaving outside air coil temperature, suction temperature, suction pressure, trend data, and ambient temperature. Once defrost operation is initiated, the outside air damper shall close, the compressor speed shall be turned down to its minimum setting, and the 4-way valve shall be reversed. During defrost operation the supply fan shall continue its normal operation, and the compressor shall be ramped up to a preset speed to maximize the melting of frost on the outdoor coil, and the indoor expansion valve shall allow a higher superheat to avoid overcooling. The auxiliary electric heater shall maintain the heating discharge air setpoint. Timed defrost sequences will not be acceptable.

E. The unit shall have an electric resistance heating coil for auxiliary heating. The heat pump shall serve as the primary heating source to optimize heating efficiency whenever there is a call for heating or until the ambient temperature has reached the adjustable low ambient compressor lockout temperature. When the heat pump operation cannot maintain the discharge air temperature setpoint the electric heating coil shall temper the airstream to the discharge air temperature setpoint. The adjustable low ambient compressor lockout temperature shall have a default setting allowing the heat pump to operate down to -10°F.

2.11 ELECTRIC RESISTANCE HEATING SECTION

A. The rooftop unit shall include an electrical resistance heating coil section. Staged electric heating coil modules shall be factory-installed downstream of the supply fan in the heating section of the rooftop unit. Heating coils shall be constructed of a low watt density, nickel-chromium alloy resistance wire with intermediate supports that include ceramic bushings. The electrical contactors shall be full line-breaking type, with all electrical power legs being disconnected when the contactors are not energized. All electrical circuit wiring shall be designed with copper conductors, aluminum wires are not acceptable. Heating element branch circuits shall be individually fused to a maximum of 48 amps per NEC requirements. The power supply for the electric heating section shall be factory-wired into the unit's main power block or disconnect switch.

B. The heating modules shall have automatic reset, high temperature limit safety protection. A secondary high limit protection shall also be provided that requires manual reset. An airflow switch shall be provided with the heating module to prevent the electric heater from operating in the event of no airflow.

C. The electric heat elements shall be controlled by the factory-installed direct digital unit control system. The heater shall have proportional SCR control. The integral unit controller shall modulate the electric heater to maintain the discharge air temperature setpoint.

D. The manufacturer’s rooftop unit ETL certification shall cover the complete unit, including the electric heating modules.

2.12 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be numbered, color-coded, and labeled according to the factory electrical diagram. The unit shall be provided with a factory-wired weatherproof control panel, a single point power terminal block for main power connection, and a terminal board for low voltage control wiring. Branch short circuit protection, a 120 volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor, condenser fan motor, and supply fan motor shall be furnished with contactors and inherent thermal overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entry.

2.13 CONTROLS

A. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All miniature circuit breakers and sensors shall be factory mounted, wired, and tested.

B. The stand-alone direct digital controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing setpoints and operate stand-alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in non-volatile memory. No settings shall be lost, even during extended power shutdowns.

C. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

D. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.

E. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to ensure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays, each with up to a 5 day duration. Each unit shall also have the ability to accept a time schedule via building automation system network communication.

F. The keypad interface shall allow convenient navigation and access to the commissioning functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum.
   1. Supply and exhaust fan speed control.
   2. All refrigeration capacities and control input signals.
   3. Refrigerant alarm details.
   4. Return air temperature.
   5. Discharge air temperature
   6. Outdoor air temperature.
   7. Outdoor high/low enthalpy.

8. Compressor suction temperature and pressure.
9. Compressor head pressure and temperature.
10. Expansion valve position.
11. Condenser fan speed.
12. Inverter compressor speed.
13. Dirty filter indication.
14. Airflow verification.
15. Cooling status.
16. Control temperature (Changeover temperature).
17. Cooling status/capacity.
18. Unit status.
19. All time schedules.
20. Previous alarms with time and date.
21. Optimal start.
22. System operating hours.

G. The user interaction with the keypad shall provide the following.
1. Controls mode
2. Cooling and heating changeover temperature with deadband.
3. Cooling discharge air temperature.
4. Supply reset options.
5. Temperature alarm limits.
6. Lockout control for compressors.
7. Compressor interstage timers.
8. Night setback and setup space temperature.
9. Building static pressure.
10. Economizer changeover.
11. Currently time and date.
12. Tenant override time.
13. Occupied/unoccupied time schedule.
14. One event schedule.
15. Holiday dates and durations.
16. Adjustable setpoints.
17. Service mode.

H. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include zone sensor with tenant override switch.

I. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and maximum discharge air temperature setpoints based on one of the following inputs.
1. Airflow.
2. Outside air temperature.
3. Space temperature.
4. Return air temperature.
5. External signal of 1-5 vdc.
6. External signal of 0-20 mA.
7. Network signal.

J. Units shall contain eight programmable input/output control ports to be controlled using the connected building automation system. These ports shall be input/output capable of utilizing the following signal types.
1. mA signal (0-20 mA, Adjustable).
2. VDC (0-10 VDC, Adjustable).
3. 10k Thermistor.
4. Digital on/off.

2.14 REFRIGERANT DETECTION SYSTEM

A. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller, and keypad/display operator interface. All miniature circuit breakers and sensors shall be factory mounted, wired and tested.

2.15 ROOF CURB

A. Provide a pre-fabricated heavy gauge galvanized steel, mounting curb for field assembly by the Contractor on the building roof deck prior to unit shipment. The roof curb shall be full perimeter type with complete perimeter support of the air handling and condensing sections. The curb shall be a minimum of 22" high and include a nominal 2"x4" wood nailing strip. Gasketing shall be provided for field mounting between the unit base and the roof curb.

B. See Specification Section 230500 (Basic Materials and Methods for HVAC Systems) for additional information and requirements.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

3.2 FACTORY AUTHORIZED STARTUP AND TRAINING

A. Engage a factory trained and authorized service representative for equipment startup and to train the Owner's maintenance personnel to adjust, operate, and maintain the equipment. Complete and submit a factory startup report that is signed by the authorized technician to the Owner and Engineer.

B. The Contractor shall video the operating and training session(s) and provide an electronic copy to the Owner and the Engineer. Videos shall be of reasonable content and quality.

3.3 ELECTRICAL CONNECTIONS

A. Ensure that the equipment is wired properly, with fan rotation in the direction indicated, as intended for proper performance.

3.4 CARE AND CLEANING

A. Repair or replace broken, damaged or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Owner’s representative. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.5 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.6 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 86 00 - SPLIT SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of units specified in this section include the following:

Split System Heat Pumps

1.3 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and identified with labels describing contents.

1. Three sets of spare air filters for each unit.

1.4 QUALITY ASSURANCE

A. ARI Compliance: Coil ratings shall be in conformance with the requirements of ARI Standard 410 (Forced-Circulation Air Cooling and Air Heating Coils).

B. Units shall be rated in accordance with Air Conditioning, Heating and Refrigeration Institute (AHRI) Standard 240 and bear the AHRI Certification label.

C. A dry air holding charge shall be provided in the indoor section.

D. The installing contractor shall have a minimum of 5 years of installation experience with the manufacturer’s product.

E. System startup supervision shall be provided by the equipment manufacturer’s representative or by an authorized representative that has been factory trained in system setup and operation.

F. Warranty: The units shall have a manufacturer’s parts and defects warranty for a period 5 years from the date of startup. The compressor shall have an extended warranty of 10 years from the date of startup. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of equipment and material listed in this section.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM HEAT PUMPS

A. General: Provide split system heat pumps having capacities, cabinet sizes, electrical characteristics, and accessories as scheduled on the drawings.

B. Capacity: Units shall be capable of heating at 0°F ambient and cooling at 100°F ambient with the capacities scheduled on the drawings. Units shall be capable of operating (at somewhat reduced capacities) at ambient air temperatures between -5°F and 115°F.

C. Outdoor Units
   1. The outdoor units shall have a thermally fused powder coated finish. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit shall be run tested at the factory.
   2. Outdoor unit shall have a sound rating no higher than 55 dB(A).
   3. Outdoor unit cabinets and mounting systems shall have a thermally fused polyester powder coat finish that meets the ASTM D3451-06 Standard.
   4. Outdoor units shall have a direct drive fan and the motor shall have permanently lubricated bearings.
   5. The outdoor unit shall be provided with manufacturer supplied wind baffles (if required to achieve the specified performance).
   6. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow/hail guard.
   7. Coil fins shall have a factory-applied corrosion resistant coating.
   8. The compressor shall be equipped with thermal overload protection.
   9. Units shall be equipped with a base pan heater to protect the coil against ice build-up during prolonged winter operation. The base pan heater shall activate only if the compressor is operating in heating mode at an outdoor temperature of 36°F or below.
   10. Units shall be 208 Volt, 1 phase, and shall have a local electrical disconnect.

D. Indoor Units
   1. The wall mounted indoor units shall be factory assembled, wired, and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, a 3 minute time delay mechanism, an auto restart function, and a test run switch.
   2. Multi-directional drain and refrigerant piping offering 4 directions for refrigerant piping and 2 directions for draining are required.
   3. An integral, motorized, multi-position, horizontal air sweep vane shall provide for uniform air distribution, both up and down. The vane(s) shall have selectable positions plus ‘Auto’ (control position based upon mode). The microprocessor shall automatically determine the vane angle to provide the optimum room temperature distribution) and vane swing (continuously moves up and down). In ‘Off’ mode the horizontal vane shall return to the closed position.
   4. The indoor unit shall include an ‘Auto’ fan setting capable of maximizing energy efficiency by adjusting the fan speed based on the difference between controller setpoint and room temperature. The indoor fan shall be capable of a minimum of 4 manual speed settings plus Auto.
   5. Return air shall be filtered by means of 2 easily removable, washable filters, and electrostatic anti-allergy enzyme filters.
   6. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil. Provide a factory-installed unit-powered condensate pump inside the cabinet. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil. A drain pan level switch, designed to connect to the control board, shall be provided and installed in the condensate pan to prevent condensate from overflowing.
   7. Indoor unit electrical power shall be 208 Volt, 1 phase, and shall be powered by the outdoor unit.
   8. The unit shall not have supplemental electric heat elements.

E. Controls: Provide wall-mounted, back-lit controllers, capable of system run/stop, operating mode selection (cool, auto, fan, heat), adjusting space temperature, fan speed, and air distribution, and displaying return air and indoor coil temperatures.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering split system air conditioning units which may be incorporated in the work include the following, or approved equal:

Daikin

2.2 REFRIGERANT PIPING

A. See Specification Section 232400 (Refrigerant Piping and Accessories).

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

3.2 ELECTRICAL WIRING

A. Install electrical devices furnished by the manufacturer but not specified to be factory mounted. Furnish a copy of the manufacturer's wiring diagram to the electrical contractor.

B. Route electrical power and control wiring in separate conduits.

3.3 REFRIGERANT PIPING INSTALLATION, TESTING, EVACUATION, AND CHARGING

A. See Specification Section 232400 (Refrigerant Piping and Accessories).

3.4 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.5 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.6 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 26 00 01 – ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General provisions of the Contract including the "General Conditions", "Supplementary Conditions", and "General Requirements" of the Contract as written and referred to here are adopted and made part of Division 26.

B. The Contract Agreement, Bidding documents, and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the electrical systems.

1.2 SUMMARY

A. The work under this Division shall consist of all labor, materials, equipment, services and related accessories, etc., necessary and required to complete all work as shown or inferred on the Drawings and in the Specifications (Contract Documents).

B. Provide fixed electrical equipment, except where specifically noted otherwise.

C. Provide portable electrical equipment for the complete system(s).

D. Provide equipment and/or wiring normally furnished or required for complete electrical systems but not specifically specified on the drawings and/or in specifications, as though specified by both.

E. All equipment and wiring shall be new, except where specifically shown or specified otherwise.

F. Provide flexible electrical conduit and conductors having a slack, 90-degree bend or loop in any plane between connections at all vibration isolated equipment and the first attachment to building structure or cabinets, panels or boxes mounted thereon.

1.3 WORK INCLUDED IN THIS DIVISION

A. Electrical work includes, but is not limited to
1. Arranging and coordinating with utility services required as shown or specified.
2. Installation of all utility conduit and infrastructure.
3. Removal or relocation of electrical services and electrical work located on or crossing through project property, above or below grade, obstructing construction of project or conflicting with completed project or any applicable code.
4. Provide meters, switchboards, panelboards, circuit breakers, power outlets, convenience outlets, switches, and/or other equipment forming part of system.
5. Complete lighting system.
6. Complete communication system.
7. Complete Audio/Visual system.
8. Connection of all appliances and equipment including Owner furnished equipment.
9. Complete grounding system.
10. Complete temporary facilities for construction power.
11. Complete fire alarm system.

1.4 WORK NOT INCLUDED IN THIS DIVISION (REFER TO OTHER DIVISIONS OF THESE SPECIFICATIONS)

A. Flashing of conduits into roofs and outside walls. Inform General Contractor of number and size of roof penetrations prior to bidding.

B. Furring of building structure or finishes for conduit and equipment.

C. Finish painting of conduit and equipment except for factory applied prime or finish painting specified for equipment, fixtures, devices or materials furnished under this section.

D. Installation of motors except where specifically noted. See Division 23.

E. Control wiring for mechanical systems, except where specifically indicated to be provided by Electrical Contractor. See Division 23.

1.5 RELATED WORK SPECIFIED ELSEWHERE

A. Classification of Excavation: Division 02 – Site work.

B. Concrete Work: Division 03.

C. Painting: Division 09.

D. Firestopping and Sealants: Division 07.

1.6 REFERENCES

NEC:	National Electrical Code (latest edition adopted by local authorities unless otherwise noted).
NFPA:	National Fire Protection Association.
OSHA:	Occupational Safety and Health Administration.
UL:	Underwriters Laboratories, Inc.
NEMA:	National Electrical Manufacturer's Association.
IEEE:	Institute of Electrical and Electronic Engineers.
ACI:	American Concrete Institute.
ADA:	American Disabilities Act.
ANSI:	American National Standards Institutes.
ASTM:	American Society for Testing Materials.
AWS:	American Welding Society.
FM:	Factory Mutual Insurance Association.
IBC:	International Building Code
IES:	Illumination Engineering Society.
ISA:	Instrument Society of America.
LPI	Lightning Protection Institute.
NACE:	National Association of Corrosion Engineers.
NETA:	International Electrical Testing Association.
UL:	Underwriters Laboratories.
NECA:	National Electrical Contractors Association
NETA:	National Electrical Testing Association.

1.7 ADOPTED CODES

A. 2024 International Building Code (IBC) Published by the International Code Council (ICC).

B. 2023 National Electrical Code (NEC) published by the National Fire Protection Association (NFPA)

C. 2024 International Fire Code (IFC) published by the International Code Council.

D. National Fire Codes (NFPA Standards) published by the National Fire Protection Association (NFPA) as referenced in the 2018 International Fire Code.

E. 2024 International Energy Conservation Code (IECC) published by the International Code Council. ASHRAE/IESNA Standard 90.1 is incorporated by reference.

F. All applicable provisions of the Nevada Revised Statutes (NRS) and the Nevada Administrative Code (NAC), including those listed below.

G. The most current regulations of the State Fire Marshal, Nevada Department of Public Safety, Carson City, Nevada (NAC Chapter 477, State Fire Marshal).

H. The most current edition of the Americans with Disabilities Act (ADA) published by the United States Department of Justice including the Americans with Disabilities Act Accessibility Guidelines (ADAAG)

I. Other codes, regulations, and standards referenced in the body of this document.

J. Local codes and ordinances do not apply to projects constructed on state-owned land, except for zoning requirements pursuant to Nevada Revised Statutes Section 278.580.

K. Northern Nevada ICC 2024 Adopted Amendments.

1.8 DEFINITIONS

Provide:	Furnish, install, connect and test until complete.
Wire:	Furnish all necessary wiring, connect and test until complete.
Install:	Furnish, set in place, wire and test until complete.
Work:	Materials completely installed, connected, and tested until complete.
AWG:	American Wire Gage.
Equal:	Acceptable equal as determined by the Engineer.

1.9 REQUIREMENTS OF REGULATORY AGENCIES

A. Obtain and pay for all permits and inspections required for the work. Comply with all ordinances pertaining to work described herein. Pay all expenses arising from the procurement of these certificates and include in the base contract price.

B. Install work under this Division per drawings, specifications, latest adopted edition of the National Electrical Code, (NFPA-70) including local amendments and interpretations, Local adopted Building Codes, and any special codes having jurisdiction over specific portions of work within complete installation. In event of conflict, install work per most stringent code requirements determined by Engineer. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such ordinances, laws, regulations and codes.

C. All materials, products, devices, fixtures, forms or types of construction included in this project shall meet or exceed the published requirements of National Electrical Code (NEC), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE) and National Electrical Manufacturers Associations (NEMA). All equipment shall bear the Underwriter's Laboratories (UL) label or equivalent from approved independent testing laboratory.

D. Arrange, pay fees for and complete work to pass required tests by agencies having authority over work. Deliver to Engineer copies of the Certificates of Inspection and approval issued by authorities and provide original copy of each certificate to Owner.

E. When required by law or regulations, the governmental agency having jurisdiction for inspections shall be given reasonable notice and opportunity to inspect the work. Any work that is enclosed or covered up before such inspection and test shall be uncovered at the Contractor's expense; after it has been inspected, the Contractor shall restore the work to its original condition at his own expense.

1.10 INSURANCE

A. The Contractor shall procure and maintain, at his expense, such insurance as required by law and/or specified in the General Conditions.

1.11 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are complementary. Work called for by one is binding as if called for by both. Any discrepancies between drawings and specifications shall be brought to the attention of the Engineer for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of his failure to have brought said discrepancies to the attention of the Consultant during the bidding period or by reason of any error on the Contractor's part.

B. Drawings are schematic and diagrammatic in nature. Drawings show general run of circuits and approximate location of equipment. The contractor shall review drawings of all trades to assure coordination prior to placement of work. Right is reserved to change location of equipment and devices, and routing of conduits within 10 feet, without extra cost to Owner (prior to rough-in).

C. Use dimensions in figures, shop drawings, etc. and actual site measurements in preference to scaled dimensions. Do not scale drawings for exact sizes or locations – use dimensioned details or actual field conditions. Verify item mounting heights as required by project conditions prior to rough-in.

D. The architectural drawings shall take precedence over all other drawings in matters of dimensions. Discrepancies between different drawings or between drawings and specifications, or regulations and codes governing the installation shall be brought to the attention of the Engineer in writing for determination.

E. Layout equipment as shown on drawings as close as possible. Verify access requirements for equipment actually furnished, and adjust layout to comply with NEC 110. Right is reserved to change layout within 10 feet without additional cost (prior to rough-in).

F. All devices, light fixtures, etc. located in ceiling tiles shall be located in the center of the ceiling tile UNLESS specifically noted or approved to do otherwise.

G. The Contractor is responsible to field measure and confirm the mounting heights and location of electrical equipment with respect to counters, doorways, and other architectural, mechanical or structural work. Do not scale distances off the electrical drawings: Use actual building dimensions.

H. Execution of Contract is evidence that Contractor has examined all existing conditions, drawings and specifications related to work, and is informed to extent and character of work. Later claims for labor and materials required due to difficulties encountered, which could have been foreseen had examination been made, will not be recognized.

I. All work called for in this Section of the plans and specifications shall be performed under this Section, regardless of whether such work may also have been called for in other Section(s). Discrepancies in or conflicts among the various parts of the contract drawings shall not relieve Contractor of his obligation to perform.

J. No attempt has been made to establish the required sections or splits of equipment relative to the size of access into the space, building, etc. Contractor shall establish all said splits, sections, etc. necessary to install equipment complete without undue disassembly of equipment or demolition of building parts at site of work.

K. Charges for extra work are not allowed unless work is authorized by written order from the Owner's Representative approving charges for work.

L. Check all door swings so light switches are not located behind doors. Relocate switches as required with the Engineer's review.

M. Elevators: The location of switches, GFCI receptacles, lights, telephone outlets, disconnect switches, fire alarm devices, etc., in elevator pits, shafts, equipment rooms shall be located as required by the Elevator Shop Drawings and applicable codes. Coordinate size and type of all electrical devices with Elevator Contractor prior to purchase of equipment.

1.12 SEISMIC QUALIFICATIONS & REQUIREMENTS

A. Equipment Seismic Qualification

Major equipment and components shall be suitable for and certified to meet all applicable seismic requirements of the California Building Code (CBC) through zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, CBC: a peak of 2.15g's and a ZPA of 0.86g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

B. Structural Design Requirements

1. Include in the bid, hiring of a structural engineer, registered in the state of Nevada, to provide calculations and details for equipment pads and mounting and bracing of all major equipment. Attach equipment according to those calculations.
2. Major equipment and components include:
   a) Conduit racks and supports.
   b) Transformers.
   c) Panelboards.
   d) Service and Distribution switchboards.
3. Equipment anchoring and bracing shall be designed to conform to IBC 2018 and NRS 341.143.

C. See Spec Section 26 05 30 Seismic Protection for Electrical Equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All material shall be new, and have a UL label where available. If UL label is not available, material shall be manufactured in accordance with applicable NEMA, IEEE and Federal Standards. Use UL labeled components in assemblies that do not have overall UL label. All equipment shall comply with the terms “listed and labeled” as defined in the NEC 70, Article 100. Submit letter stating compliance with these requirements.

B. Utilize one of the manufacturers listed to furnish all of the major equipment (i.e., transformers, bus duct, switchgear, circuit breakers, etc.) required for this project.

C. In all cases, there is one basis of design manufacturer or product for each item of equipment or product shown on the drawings and/or specified herein. These products are identified by name and model number on the drawings and/or in the specifications. Alternative manufacturers and products are also listed; however their inclusion as an alternative manufacturer or product does not cause them to be the basis of design. If an alternative manufacturer and/or product is desired to be used by the Contractor, it will be considered a substitution. Substitutions will be interpreted to be all manufacturers or products other than the basis of design. Only one request for substitution will be considered for each item of material or equipment. No substitutions will be considered thereafter. After a substitution request is reviewed and is found to be unacceptable the Architect/Engineer reserves the right to require the originally specified equipment or product at no additional cost to the Owner.

D. In any case where the Contractor intends to utilize a listed or unlisted acceptable equipment manufacturer that is not the basis of design as listed on the drawings and in the specifications, it is the Contractor’s responsibility to confirm prior to bidding that all ductwork, piping, controls, electrical power, conduit, service clearances, space requirements, and structural requirements match those of the basis of design equipment. Costs for any revisions necessary to accommodate the ductwork, piping, controls, electrical power, conduit, service clearances, space requirements, and structural requirements for the alternative equipment are the responsibility of the Contractor and shall be included in the Contractor’s bid, this includes any costs associated with re-design or necessary calculations by the project Architect or Engineers. No extra cost will be allowed for failure to allow for accommodations related to the alternative equipment in the Contractor’s bid.

E. Submit to the Architect/Engineer for review, within a reasonable time after award of Contract and in ample time to avoid delay of construction, shop drawings or submittals on all items of equipment and materials, including all substitutions. Also see Division 1 for additional related requirements.

F. If the Contractor desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified. No substitutions will be allowed unless requested and reviewed in writing. The Architect/Engineer will review and take appropriate action on shop drawings, product data, samples, and other submittals as required by the contract documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the contract documents. The review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor. Review of a specific

item shall not indicate acceptance of an assembly of which the item is a component. The Architect/Engineer shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the Contractor, nor shall the Architect/Engineer be required to review partial submissions or those for which submissions for correlated items have not been received. The Architect/Engineer reserves the right to require the originally specified item at no additional cost to the Owner.

G. Installation of reviewed substitutions is the Contractor's responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the Owner. Review by the Architect/Engineer of the substituted equipment and/or the dimensioned drawings does not waive the requirements stated herein.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION

3.1 VISIT TO SITE

A. Visit site, and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the electrical work, including relocation of existing services and utilities on building site in bid. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference's shall be reported immediately to the Engineer.

3.2 WORKMANSHIP

A. All work performed shall be first class work in every aspect. The work shall be performed by mechanics skilled in their respective trades, who shall at all times be under the supervision of competent persons. All work shall be installed to comply with NECA's "Standard of Installation."

B. Work under this Division shall be first class with emphasis on neatness and workmanship. All work shall be installed square and plumb and concealed where possible. Work that is deficient, defective, poorly laid out, not perfectly aligned, or that is not consistent with the requirements generally accepted in the trade for "first class work" will not be acceptable.

C. In addition to the materials specified elsewhere, furnish and install all other miscellaneous items necessary for the completion of the work to the extent that all systems are complete and operative.

D. All work under this Section shall be performed in cooperation with the work performed under all other Sections of the Specifications for the Project in order to avoid interference with other work and to secure the proper installation of all work. Refer the Drawings and Specifications covering

the work to be performed under all Sections, so that the relation and extent of the work of this Section with respect to the work of all other Sections is understood. Give right of way to raceways and piping systems installed at a required slope.

E. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. The installation shall be subject to the Engineer's observation, and final acceptance. The Engineer may reject unsuitable work.

F. Conduit systems must be complete prior to installation of wiring.

3.3 CHANGE ORDERS

A. Additional work may be required on the project which is outside the scope of the contract. Such additional work will be described in Supplemental Instructions and/or Clarifications, to be estimated and priced by the Contractor, and accepted by the Owner, prior to commencing work. Proposals shall include a list of quantities of all material being used with unit costs broken down into material and labor costs per unit, along with quotations from suppliers for equipment/devices/components.

B. Material costs and labor units shall not exceed the latest edition of RS Means Electrical Cost Data.

C. See the General Conditions of the Specifications for acceptable charges.

3.4 GUARANTEE

A. Furnish the Owner a written guarantee, stating that if workmanship and/or material executed under this Division is proven defective within one (1) year after final acceptance by the Owner, such defects and other work damaged will be repaired and/or replaced. Submit with Operations and Maintenance Manuals.

B. Obtain from the various manufacturers or vendors guarantees or warranties for their particular equipment or components, and deliver them to the Owner. All guarantees and warranties provided shall be referenced to this project.

C. In event that systems are placed in operation in several phases at the Owner's request, guarantee will begin on date each system or item of equipment is accepted for service by the Owner. Provide O&M manuals for all equipment when equipment is accepted for service by the Owner.

D. All guarantees and warranties shall include labor and material at the site of installation for the duration of the guarantee period.

3.5 OBSERVATIONS OF WORK AND DEMONSTRATION OF OPERATION (ACCEPTANCE)

A. At all observations of work, open panel covers, junction box covers, pull box covers, device covers, and other equipment with removable plates for observation. Provide sufficient personnel to expedite cover removal and replacement.

B. Contractor to demonstrate operation of new equipment and/or systems to satisfaction of Owner/Engineer. Contractor to have manufacturer available for demonstration of equipment and/or systems where requested by Owner/Engineer. Furnish affidavit signed by Owner's representative indicating that demonstration of operation has been performed.

3.6 COOPERATION AND COORDINATION

A. Carefully coordinate work with other contractors and subcontractors. Refer conflicts between trades to Engineer. Provide necessary information to other trades for such coordination. Such information shall include Shop Drawings, Product Data and all other required data. There shall be no additional cost to the owner for any post-bid changes made to the electrical design and/or construction that are generated by changes to the basis-of-design equipment of any discipline. This includes changes made by substituted, alternate or comparable products regardless of manufacturer.

B. Provide a system erection/coordination drawing showing electrical, HVAC, plumbing and architectural for installation in congested areas. Drawings shall be in plan view for work above the ceilings and also sections shall be provided showing the elevations of conduit racks and routing and the coordination with mechanical piping and ductwork.

C. Whenever such information is not provided in a timely manner or whenever such information is incorrect, this contractor shall bear all costs for providing or correcting affected work of related trades with no change to the Contract Price or Construction Schedule.

D. Work to be installed as progress of project will allow. Schedule of work determined by General Contractor, Owner, and/or Architect/Engineer.

3.7 COORDINATION OF UTILITY SERVICES

A. Drawings indicate proposed service layouts. The Contractor shall provide and install all concrete structures, pads, pullboxes, vaults, trenching, raceways, protective bollards, etc., as required per NV Energy standards.

3.8 HVAC CONTROL WIRING

A. Control Wiring including low voltage and line voltage interlock wiring will be furnished and installed under Division 23, except where specifically shown otherwise. Carefully coordinate power and control wiring interface.

B. This Contractor shall obtain from Division 23 all wiring diagrams associated with the HVAC work and furnish all power and 120V control wiring, disconnects and starters for equipment not already packaged with these items. All wiring and conduit associated with the HVAC Temperature Control System is included under Division 23. Wiring and conduit shall comply with Division 26. All electrical work associated with the HVAC system shall be done under the supervision of Division 23.

3.9 STARTERS

A. Separately mounted starters are furnished and installed under Division 26 unless specifically shown otherwise. All power wiring, fuses, thermal overloads, and disconnect switches and connection of all motors is under this division. Provide the proper feeders and connections as recommended by the manufacturer of the equipment. See Spec Section 26 29 13 Enclosed Controllers.

3.10 PROTECTING

A. Provide warning lights, bracing, shoring, rails, guards and covers necessary to prevent damage or injury. All persons working around electrical equipment shall have electrical shock and flash protection per OSHA 1910.301-309 & 331-335.

B. Do not leave exposed or unprotected, electrical items carrying current. Protect visitors and workers from exposure to contact with electrically energized surfaces, parts, etc. in accordance with OSHA standards.

3.11 DELIVERY, STORAGE AND HANDLING

A. Deliver equipment and materials to job site in original, unopened, labeled container. Products shall be properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification. Store to prevent damage and injury. Store materials to prevent corroding. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters. Contractor shall verify the availability of on site storage space, if no on site storage space is available then the contractor shall cover the cost for off site storage. Materials stored at the project site that becomes soiled with construction dirt, concrete, or moisture shall be removed from the site and replaced with new. Do not install soiled material.

B. Protect work and materials from damage by weather, entrance of water or dirt. Cap and mark conduit during installation.

C. Avoid damage to materials and equipment in place. Repair, or remove and replace damaged work and materials.

D. Protection and safekeeping of products stored on premises is responsibility of Contractor supplying products.

E. Schedule of deliveries and unloading to prevent traffic congestion blocking of access or interference with work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.

F. Install equipment per manufacturer's recommendations. Conflicts between contract documents and these recommendations shall be referred to Engineer for remedy.

G. Electrical or electronic equipment that has been damaged, exposed to weather or is, in the opinion of the Engineer or Architect, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

3.12 ANCHORS

A. Provide anchors for all equipment, raceways, hangers, etc. to safely support weight of item involved plus 100% for dead loads. Live loads shall be considered in addition to dead loads.

B. Anchors to consist of expansion type devices similar to "Redhead" or lead expansion anchors. Plastic anchors are not acceptable.

C. Use preset anchor steel inserts in concrete slabs. Provide preset anchor size and type for anticipated or specified rod/bolt size and live/dead load.

3.13 CLEANING AND PAINTING

A. Clean equipment furnished in this Division after completion of work. Clean wipe the interior of all conduit, pullboxes, junction boxes, outlet boxes, and panelboard backboxes, soiled with dirt and debris prior to installation of wiring.

B. Touch-up or re-paint damaged painted finishes as determined by the Engineer.

C. Remove debris, packing cartons, scrap, etc., from site daily.

3.14 SPARE PARTS

A. Where spare parts are specified in the Technical Sections, furnish spare parts to Owner with itemized receipt. Contractor is responsible to deliver parts and have receipt signed by Owner's representative. Turn over receipt with as-built documents.

3.15 HOUSEKEEPING PADS

A. Furnish 2500 # concrete pads, 4” high (interior locations) or 6” high (exterior locations) unless otherwise noted, for all freestanding equipment, i.e.: switchboards, panels, control panels, motor control centers, transformers, etc. Pads shall have 1" x 45° chamfered edges, and shall extend 2” to 4" beyond equipment mountings.

3.16 TRAINING

A. Training for operation and maintenance of new systems or modifications to existing systems is specified in Technical sections. Contractor shall submit with record documents an itemized receipt signed by Owner’s representative that all specified training has been received.

3.17 ACCESS PANELS

A. The contractor shall furnish all access panels for walls, partitions, etc., and shall give access panel to the General Contractor for installation at locations as directed by the Electrical Contractor. It shall be the responsibility of the Electrical Contractor that access panels are provided for access to all boxes, bus joints, equipment, etc., which may be concealed by building construction to comply with the NEC and NFPA. Access panels shall be installed so as not to interfere with lighting arrangements.

3.18 CONDUIT ROUTING

A. All penetrations through slab-on-grade and concrete-filled metal decks to be sealed watertight. See Section 07 92 00 – Joint Sealants.

END OF SECTION 26 00 01

SECTION 26 00 02 – ELECTRICAL SUBMITTALS

PART 1 – GENERAL

1.1 DESCRIPTION OF SUBMITTAL CATEGORIES

A. The required submittals are defined below and specified in each section.
1. Requests for substitutions are written requests to use materials, equipment, etc., different from that specified.
2. Shop Drawings include fabrication, layout, wiring diagrams, erection, setting, coordination, drawings and diagrams and performance data.
3. Samples are units of work, materials or equipment items, showing the workmanship, pattern, trim and similar qualities proposed.
4. Manufacturer's Data is standard printed product information concerning the standard portions of the manufacturer's products.
5. Certifications are written statements, executed specifically for the project application by an authorized officer of the contracting firm, manufacturer, or other firm as designated, certifying to compliance with the specified requirements.
6. Test Reports are specific reports prepared by independent testing laboratories, showing the results of specified testing.
7. Industry Standards are printed copies of the current standards in the industry.
8. Manufacturer's Product Warranties are manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed by the manufacturer if the product fails under certain conditions and times limits.
9. Operating Instructions are the written instructions by the manufacturer, fabricator or installer of equipment or systems, detailing the procedures to be followed by the Owner’s in operation, control and shut-down.
10. Maintenance Manuals are the compiled information provided for the Owner’s maintenance of each system of operating equipment.
11. Maintenance Materials (spare parts) are extra stock of parts or materials for the Owner's initial use in maintaining the equipment and systems in operation.
12. Record Drawings are accurate representations of the installed systems and wiring as recorded on a daily “as-installed” basis.
13. Guarantees are signed commitments to the Owner that certain acts of restitution will be performed if certain portions of work fail within certain conditions and time limits.
14. Product Data includes manufacturer's data pertaining to the products, materials and equipment of the work.
15. Method of Procedures are detailed sequences of work required during interruption of service and/or connection to energized parts of systems requiring special sequences or protections.
16. Training – Materials and sign-off of completion.
17. Identification nomenclature – See section 26 05 53.

PART 2 – PRODUCTS

2.1 PROPOSED MATERIAL MANUFACTURERS

A. Submit to Consultant within 30 days after award of contract a complete list of proposed material manufacturers. List does not preclude submission of shop drawings. Acceptance of manufacturer on list does not constitute acceptance of specific material or equipment. If shop drawings are submitted with non approved substitutions, the contractor will pay the expense incurred by the consultant to review the shop drawings of any re-submittal.

PART 3 – EXECUTION

3.1 SUBSTITUTIONS

A. See General Conditions of the specifications for information regarding substitutions. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples if requested by Engineer are provided. Alternate products shall meet or exceed design criteria.

3.2 SUBMITTAL FORM AND PROCEDURES

A. Shop and Erection Drawings
1. Submit shop drawings for material and equipment furnished under Division 26 of specifications, to Consultant for review within 30 days after award of contract. Shop drawings shall be submitted on timely basis to allow adequate lead time for review, re-submission if necessary, manufacture and delivery to allow access of material to project at correct time based on schedule established by Consultant/Contractor. Provide index with thumb tabs collated with Table of Contents for sections. Include complete descriptive data with dimensions, operating data and weight for each item of equipment. Carefully examine shop drawings to assure compliance with drawings and specifications prior to submittal to Consultant. **Shop drawings and submittals shall bear the stamp of approval of the Electrical Contractor as evidence that they have checked the drawings.** Drawing submitted without this stamp of approval will not be considered and will be returned for proper re-submission. All shop drawings shall be submitted as a single one time complete package. Partial packages shall not be reviewed.
2. Submit format per general project conditions.
3. **Clearly mark each shop drawing item to correspond to drawings and specifications. Any drawings not clearly marked will be rejected.**
4. Review of shop drawings does not relieve Contractor of responsibility for errors and omissions in shop drawings. Contractor is responsible for dimensions and sizes of equipment. Inform Engineer in writing of equipment differing from that specified.

B. "Record" Drawings
1. One complete set of prints will be furnished to the Contractor to indicate actual location of conduit systems, outlets, and equipment. Keep set of prints on job and record day to day changes to Contract drawings with red pencil. Provide “Record" drawings as specified in the General Conditions or Division 01 of the specifications at the completion of job.

C. Maintenance Materials
1. Submit a list of all warranties and guarantees.
2. Submit with final close out documents a signed receipt for all maintenance materials (spare parts) specified. See Technical Sections for required materials.

D. Product Warranties and Guarantees
1. Submit fully executed Product Warranties and Contractor Guarantees to the Owner with final close out documents.

E. Maintenance Manuals
1. Submit to Consultant data prepared by manufacturer for each item and/or device of electrical equipment furnished in this contract completely describing and identifying equipment. Data to include serial numbers, catalog/model numbers, parts lists, description of operation, final shop drawings, wiring diagrams, all electrical ratings, set-up and maintenance procedures and other literature required for maintenance of equipment. See Technical Sections for other required information.

Summary of Project Closeout Items for Owner

2. Certificates of inspection and approval from authorities having jurisdiction.
3. Executed Guarantees and Product Warranties.
4. “Record” drawings.
5. Final shop drawings.
6. Final Erection drawings.
7. Receipt for maintenance materials (spare parts).
7. Maintenance manuals.
8. Receipt for keys.
9. Completed test reports.
10. Signed off observation and punch lists.
11. Lien waivers.

3.3 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop drawings shall include, but not be limited to the following:

1. Shall be drawn to accurate scale except where diagrammatic representations are specifically indicated.
2. Shall show clearance dimensions of critical locations and show dimensions of spaces required for operation and maintenance of equipment.
3. Shall show conduit and conductor connections and other service connections.
4. Shall show interfaces with other work including structural support.
5. Shall include complete descriptive data, with dimensions, operating data and weight.
6. Shall indicate deviation from the contract documents.
7. Shall explain deviations.
8. Shall show short circuit current ratings for all electrical equipment.
9. Shall show how deviations coordinate with portions of the work, currently or previously submitted.

B. Review of shop drawings shall not relieve Contractor of responsibility for errors or omissions in shop drawings. Any equipment that will not fit into space shown on drawings shall be called to the attention of the Engineer in writing.

C. Samples: Submit samples where requested by Engineer. Engineer’s review of sample submittals

1. Shall be limited to general type, pattern and finish.
2. Shall not include testing and inspection of the submitted samples.
3. Shall not indicate complete compliance with specified requirements. Complete compliance with specifications is the exclusive responsibility of the Contractor.

D. Manufacturer's Data

1. Where pre-printed data covers more than one distinct item, mark copy to *clearly* indicate which item is to be provided.
2. Contractor shall delete portions of data not applicable.
3. Contractor shall mark data showing portion of operating range required for project application.
4. Elaboration of standard data describing a non-standard product shall be processed as a shop drawing.
5. For each product Contractor shall include the following information summarized into a single sheet document for each product
    a) Manufacturer's production specifications including catalog/model number.
    b) Manufacturer’s Serial Number.
    c) Installation or fabrication instructions.
    d) Source of supply.
    e) Sizes, weights, speeds and operating capacities.
    f) All electrical ratings, including temperature rating of terminals.
    g) Conduit and wire connection sizes and locations.
    h) All thermal ratings.

i) Statements of compliance with required standard and governing regulations.
j) Cooling requirements and makeup and/or ventilating air requirements.
k) Performance data, where applicable.
l) All sound ratings.
m) Other information needed to confirm compliance.
n) Manufacturers recommended parts list.
o) Other information required by Technical Sections.

E. Source Codes: Provide Source Code in both electronic and paper format and Source Code Licenses for all equipment that is computer driven. Provide Development licenses so Source Code can be examined, modified, and maintained. These Development Licenses, along with all software licenses shall become property of the Owner. At the discretion of the owner, third parties will be allowed to use the software as necessary, for the life of the work in this project. No encryption or other obfuscation will be allowed.

F. Certifications: Contractor shall submit with notarized execution.

G. Test Reports: Submit notarized test reports signed and dated by firm performing test.

H. Manufacturer's Product Warranties: Contractor shall submit product warranties in accordance with the technical sections. Where published warranty includes deviation from required warranty, product is disqualified from use on project, unless manufacturer issues a specific project warranty.

I. Operating Instructions required
1. Submit manufacturer's operating instructions for each item of electrical equipment.
2. Submit supplement with additional project application instructions where necessary.
3. Submit specific operating instructions for each electrical system that involves multiple items of equipment.
4. Submit instructions for charging, start-up, control or sequencing of operation, phase or seasonal variations, shut-down, safety and similar operations.
5. All operating instructions shall be typewritten in completely explained and easily understood English language.

J. Maintenance Manual Requirements
1. Provide emergency instructions including addresses and telephone numbers for service sources.
2. Provide regular system maintenance procedures.
3. Indicate proper use of tools and accessories.
4. Provide wiring and control diagram for each system.
5. Provide manufacturer's data for each operational item in each system.
6. Provide source code submittal for all software controlled equipment.
7. Provide manufacturer's product warranties, and guarantee relating to the system and equipment items in the system.
8. Provide Final Shop and Erection drawings relating to the system.
9. Bind each operating and maintenance manual in one or more vinyl-covered, 2” 3-ring binders, plus pocket-folders for folded drawings. Index with thumb tab collated with Table of Contents for sections. Mark the back spine and front cover of each binder with system identification and volume number.

K. Maintenance Materials: Deliver all materials to the Owner in fully identified containers or packages suitable for storage. Obtain receipt for all delivered materials signed by the Owner’s Representative.

L. Guarantees: Where indicated as "Certified", provide guarantee which, in addition to execution by an authorized officer of each guarantor, is attested to by the Secretary of each

guarantor and bears the corporate seal. Submit draft of each guarantee prior to execution.

END OF SECTION 26 00 02

SECTION 26 00 03 – TEMPORARY ELECTRICAL FACILITIES FOR CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish temporary electrical facilities to provide lighting and power for construction. Temporary power must be installed in accordance with the National Electrical Code, National Electrical Safety Code, local utility, local codes and authority having jurisdiction.

B. Coordinate temporary electrical facilities with other trades.

C. See General Conditions, Supplemental General Conditions and Spec Section 01 50 00, Temporary Facilities and Controls for additional information.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General: Provide new or used materials and equipment suitable for intended use. Ensure safe, adequate performance of facilities in accordance with governing regulations. Used equipment shall be in good, safe working order.

PART 3 - EXECUTION

3.1 INSTALLATION AND OPERATION

A. Except for self-contained facilities, connect and terminate temporary electrical facilities at locations required for proper distribution.

B. Do not subject electrical facilities on either temporary work or temporary use of permanent work to excess demand or overload.

C. All conduit and wiring used for temporary purposes shall be routed as to not damage any permanent finish or surface within the building. All surfaces shall be patched and repaired to that of a new finish.

3.2 SERVICE CONNECTION

A. Obtain temporary service from NV Energy. Install service in conformance with NEC 230 and 590.

3.3 GROUNDING

A. Power service and distribution system shall be properly grounded in accordance with NEC requirements.

B. Ground the system neutral in accordance with NEC 250.

C. Provide feeders and branch circuits with ground wire sized per NEC 250-122**.**

3.4 POWER SYSTEM AND DISTRIBUTION

A. Provide required distribution and capacity of system. Over-current protection, fusible and/or circuit breakers sized per NEC.

B. For 120/240 volts, single-phase system; use 3-wire 120/240-volt feeders and branch circuits.

C. For 120/208 volt, 3 phase, 4-wire system; use 120/208 volt balanced single-phase 3-wire distribution or 120/208 volts, 3 phase, 4-wire distribution.

D. For 480 volt, 3 phase, 3-wire distribution system; use balanced 2-wire single phase or 3-wire, 3 phase feeders for step-down to 120/240 volt or 120/208 volt utilization.

E. For 277/480 volt distribution system; use balanced 2-wire single phase or 3 and 4-wire, 3 phase feeders for step-down to 120/240 volt or 120/208 volt utilization.

F. Step-down transformers inside building shall be dry-type construction; protect from weather and construction damage.

G. Use No. 12 wire for branch circuits less than 100 feet to last outlet, and No. 10 wire for circuits beyond 100 feet. Install branch circuits using NEC approved wiring methods.

H. Balance loads connected to 3 phase services within reasonable limits.

3.5 PLUG-IN RECEPTACLES

A. Use 20A, duplex, NEMA grounded type or as required for special equipment.

B. Branch circuits feeding receptacles shall be 20A or as required for special equipment.

C. Provide receptacles to be reached by 50-foot extension cord.

D. All receptacle circuits shall be protected by dynamic type ground-fault circuit interrupters, which automatically disconnect circuit when leakage current of 4-6MA is detected.

E. Receptacles shall not be placed on the same circuit with temporary lighting.

3.6 TEMPORARY LUMINARIES

A. Provide luminaries approved by NEC for temporary construction wiring.

B. Lamps shall be rough service incandescent 150 watt to 300 watt equipped with guards to protect from contact and damage (sizes as directed).

3.7 LAMPS AND REPLACEMENTS

A. Provide lamps.

B. Replace burned out lamps to maintain required lighting levels throughout the duration of the project.

3.8 INSTALLATION OF CIRCUITS

A. Install required lighting and receptacle circuits along a route least objectionable to construction work as determined by Contractor. Protect circuits where exposed to damage.

3.9 PERMANENT WIRING SYSTEM

A. Do not use permanent wiring for construction without specific acceptance of the Owner. Before using permanent wiring for temporary service, submit a list of uses to the Owner. The Owner may refuse use of permanent equipment for temporary service. Use of permanent equipment prior to Substantial Completion shall not affect warranty period.

3.10 REMOVAL AND RESTORATION

A. Temporary wiring shall be removed immediately upon completion of construction or purpose for which the wiring was installed. Repair or replace work damaged by temporary electrical facilities. Clean and restore permanent electrical system used to provide temporary services to condition of new and unused work. Patch and seal all penetrations.
   1. Electrical work installed as temporary facilities, upon removal, remains property of Installer.
   2. Replace lamps of permanent light fixtures used for temporary lighting that have burned out or are noticeable dim. All permanently installed fixtures in the construction area lamps shall be removed and cleaned.
   3. Where temporary use of lamps exceeds 50 percent of lamp life, replace lamps.

B. At Substantial Completion, clean permanent electrical work used as temporary facilities. Remove debris accumulated in electrical spaces.

END OF SECTION 26 00 03

SECTION 26 05 03 – EQUIPMENT WIRING CONNECTIONS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

B. Related Sections:
   1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
   2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Submittal procedures.

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

A. General Conditions: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 CORD AND PLUGS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

C. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 – EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations and to motors.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 ADJUSTING

A. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION 26 05 03

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building wire and cable and wiring connectors and connections.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.
   2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriters Laboratories, Inc.:
   1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Solid conductor for feeders and branch circuits 12 AWG and smaller.
   2. Stranded conductors for feeders and branch circuits 10 AWG and larger.
   3. Stranded conductors for control circuits.
   4. Conductor not smaller than 12 AWG for power and lighting circuits.
   5. Conductor not smaller than 16 AWG for control circuits.
   6. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent. See section 3.3-W for receptacle and lighting branch circuits. Utilize loads shown in panel schedules for all other load types to maintain maximum 3% voltage drop.

B. Wiring Methods: Provide the following wiring methods:
   1. All Locations Unless Noted Otherwise: Use only building wire, Type THHN/THWN or XHHW insulation, in raceway.

1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper, aluminum conductors are not acceptable.

1.5 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Product Data: Submit for building wire.

C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.

D. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

A. General Conditions: Requirements for coordination.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Product Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 90 degrees C.

E. Insulation Material: Thermoplastic.

2.2 ARMORED CABLE

A. Type AC Cable may not be used on this project.

2.3 METAL CLAD CABLE

A. Type MC Cable may not be used on this project and is strictly prohibited.

2.4 CONNECTORS AND SPLICES

A. Provide UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, type and class for application and for service indicated. Select connectors to comply with Project's installation requirements and as specified in Part 3 "Applications" of this Article.

B. For Conductors #10 AWG and Smaller: Wire and cable connectors shall be solderless, twist on, 600 volts, 105°C., shall comply with UL 486A/C standards. Connectors coded for easy selection compatible with wiring to be spliced. Install connectors as recommended by manufacturer. Use proper crimping tool where crimp sleeves are used.
1. Acceptable Connector Manufacturers
    a) 3M- "Scotchlock"
    b) Buchanan - "B Cap"
    c) Thomas & Betts - "Stak-On"
    d) Ideal - "Wing Nuts"

C. Compression Splices: Splice conductors #8 and larger with solid copper barrel, type fittings applied with an appropriate hydraulic tool. Splices used only where approved. Splice fittings: Burndy "Hydent". Insulate splices with 600 volt, 105°C, "heat shrink", "cold shrink" covers, or taped insulation consisting of rubber, friction and vinyl tapes applied per manufacturer for 600 volt, 105°C covering to 150 percent of installation rating of conductor.
1. Acceptable Splice and Tape Manufacturers
    a) Burndy
    b) Thomas & Betts
    c) Ilsco
    d) Anderson
    e) Blackburn
    f) Oz/Gedney

D. Connectors and/or Terminations for Conductors #6 AWG and larger: Tin plated, 98% copper, dual crimp long barrel compression lugs with two bolt holes, insulated with molded covers to accommodate 1/2" bolts. Apply with hydraulic tool recommended by manufacturer.
1. Acceptable Manufacturers and Products
    a) O-Z Gedney
    b) Burndy Engineering Company "Hylugs"
    c) Thomas and Betts, "Color Keyed"
    d) Anderson

E. Use pulling lubricant which will not be detrimental to insulation of conductors indicated by published user information.
1. Acceptable Manufacturers of Lubricant
    a) Ideal Industries
    b) Panduit Corp.
    c) OZ/Gedney
    d) Plymouth/Bishop
    e) American Polywater Corp.
    f) Thomas & Betts

F. Insulate all live joints to 600 volts with strip rubber, friction tape, and electrical vinyl tape installed in accordance with manufacturers recommendations.
1. Acceptable Tape Manufacturers
    a) 3M
    b) Plymouth

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable under provisions of Section 260553. Identify each conductor with its circuit number or other designation indicated.

D. Install wiring complete with connections to equipment.

E. There may be cases where circuit or feeder conductor sizes are too large or too small to fit into the lugs normally supplied with the power distribution equipment or end-use equipment, due to circumstances such as increasing conductor sizes to offset voltage drop, unusual breaker frame sizes, type of conductors used, etc. In such cases provide appropriate factory lug kits for affected equipment if recommended by manufacturer; elsewhere provide insulated butt-splices with tails sized to fit respective lugs.

F. Install wiring so conductors are not in tension in completed system.

G. Form wiring neatly and group in circuit. Tie grouped conductors with nylon ties, T&B "Tyrap" or approved equivalent.

H. Each conduit run shall be run complete end to end before conductors are installed.

I. Use pulling lubricant to decrease pulling tension for all feeder cables, and all difficult cable pulls of any type or size. Pull all conductors into raceway at the same time.

J. Provide cable supports, at locations required by NEC and/or as shown. Supports with malleable screwed conduit fitting and non-conductive wedges drilled for the size conductors installed. Provide supports rated for all types of insulation and all voltage. Cable supports shall be O.Z./Gedney type "R" or accepted equivalent. Furnish pullbox, sized per NEC for each cable support.

K. Bond circuit ground wires where installed to all devices, equipment, outlet and junction boxes, and grounding bushings (where provided) with a full size conductor and lugged type connection.

L. Securely fasten non-ferrous identifying tapes, pressure sensitive labels or engraved nameplates to all cables, feeders and power cables exposed in vaults, inside pull boxes, exposed in manholes, exposed in switchboard, termination compartments, etc

M. Join and terminate copper conductors individually. Do not mix voltages in the same raceway.

N. Provide lugs where not furnished as part of equipment - furnish as specified above, to connect all conductors.

O. Furnish lugs for conductors #1/0 and larger with two bolt tongue or accepted equivalent single bolt tongue with anti-turn devices.

P. Mark all branch circuit conductors at panel terminations including neutrals with pressure sensitive numbers to correspond to circuit numbers connected. See Section 260553 for labels.

Q. Connect circuits and feeders as shown on drawings. Drawings are diagrammatic and do not show every detail required in the wiring system. Detail wiring accomplished per NEC.

R. All conductors making up parallel feeders to be same size, same type, and same insulation, all cut same length. Bond each group of conductors making up a phase or neutral at both ends in an approved manner. Parallel conductors shall not be run in the same raceway.

S. DO NOT COMBINE CIRCUITS into more than three circuits per homerun unless specifically approved by the Consultant.

T. Neutral conductors shall not be used for equipment grounding.

U. Circuitry shall not be run in elevator shafts and hoistways.

V. Provide a separate neutral and grounding conductor for all GFI circuits or GFI devices to ensure an adequate ground-fault return path.

W. Conductors for general purpose receptacle and all lighting circuits shall be installed in accordance with the following conditions:

1. Maximum one-way circuit length in feet for 90°C copper conductors with unity power factor to first device on circuit. Assumed 1920VA/120V and 4432VA/277V loading per circuit.

   a. 120V – Single Phase
      1) #12AWG – 53’
      2) #10AWG – 88’
      3) #8AWG – 138’
      4) #6 AWG – 223’

   b) 277V – Single Phase
      1) #12AWG – 123’
      2) #10AWG – 205’
      3) #8AWG – 319’
      4) #6AWG – 515’

X. Panelboards may not be used as raceways.

Y. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

Z. Install terminal lugs on ends of 600-volt wires unless lugs are furnished on connected device, such as circuit breakers.

AA. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

BB. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

CC. Clean conductor surfaces before installing lugs and connectors.

DD. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3.4 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
   2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

B. Related Sections:
1. Section 03 20 00 - Concrete Reinforcing: Bonding or welding bars when reinforcing steel is used for electrodes.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Metal underground water pipe.
2. Metal building frame.
3. Concrete-encased electrode.
4. Rod electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Installation Instructions: Submit for active electrodes.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. General Conditions: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

A. General Conditions: Requirements for coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

A. Product Description:
   1. Material: Copper-clad steel.
   2. Diameter: 3/4 inch (19 mm).
   3. Length: 10 feet (2.4 m).

B. Connector: Connector for exothermic welded connection.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: As shown on drawings.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare.

2.3 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches NPS (DN200) by 18 inches (600 mm) long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.4 MECHANICAL CONNECTORS

A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation. Where connection is made to domestic water with a bonding connector, contractor shall remove all paint/tape at connection point to adequately expose bare copper for a proper bonding connection.

2.5 EXOTHERMIC CONNECTIONS

A. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Verification of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system to maintain continuity to accommodate renovations.

B. Extend existing grounding system using materials and methods as specified.

3.4 INSTALLATION

A. Install in accordance with IEEE 142.

B. Install grounding and bonding conductors concealed from view.

C. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

D. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings. Electrically bond steel together.

E. Bond together metal siding not attached to grounded structure; bond to ground.

F. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

G. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

H. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

I. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

J. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

K. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.5 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground resistance testing in accordance with IEEE 142.

E. Perform continuity testing in accordance with IEEE 142.

F. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION 260526

SECTION 26 05 29 – HANGERS, SUPPORTS AND FIRESTOPPING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

1.2 REFERENCES

A. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479, to achieve fire ratings of adjacent construction. In accordance with Design Numbers.

B. Surface Burning: UL 723 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to UL for fire resistance ratings and surface burning characteristics.

1.6 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience approved by manufacturer.

1.9 PRE-INSTALLATION MEETINGS

A. General Conditions: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. General Conditions: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F (15 degrees C).

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 – PRODUCTS

2.1 CONDUIT SUPPORTS

A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

2.2 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage (2.8 mm) thick steel. With holes 1-1/2 inches (38 mm) on center.

2.3 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

A. Furnish materials in accordance with project standards.

B. Sleeves Through Non-fire Rated Floors: 18 gage (1.2 mm) thick galvanized steel.

C. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 mm thick galvanized steel.

D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

E. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Manufacturers:
1. Dow Corning Corp.
2. 3M fire Protection Products.
3. Specified Technology, Inc.
4. Substitutions: General Conditions

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.

5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: Dark gray.

2.7 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:
1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 – EXECUTION

3.1 EXAMINATION

A. General Conditions: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Obtain permission from Architect/Engineer before using powder-actuated anchors.

D. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide precast inserts, expansion anchors, and preset inserts.
2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

B. Inserts:
1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards
1 inch (25 mm) off wall.
4. Support vertical conduit at every floor.

G. Support EMT within twelve inches of each outlet, junction box, cabinet or fitting and every eight-foot thereafter. Combination box/conduit hangers are not allowed.
1. Acceptable Individual conduit hanger manufacturers
a. Appleton
b. Minerallac
c. OZ Mfr. Co.
d. Erico-Products
e. Steel City
f. Thomas & Betts

H. Support for multiple conduit runs shall consist of trapeze type hangers as required. Galvanized bolts or rods shall be 3/8” minimum diameter and anchored to structure. Provide support system clamp for each conduit on hangers. Support systems shall utilize 1-5/8” x 1-5/8” x 12 gage multi-purpose steel channels, complete with all necessary hardware, clamps, etc. all channel hardware shall be galvanized and/or plated to prevent corrosion. Channel sizes and quantity, and number of support rods shall be increased to support increased weights. Design each assembly to carry the combined weight of conduit and wire, assembly itself plus 100 pounds. Provide space for 25 percent additional conduit of the same size.

I. 1. Acceptable Manufacturers of channel support Systems
   a. B-Line
   b. Kindorf
   c. Superstrut
   d. Unistrut

I. All hangars for electrical items (conduit, boxes, fixtures and all other related equipment) where an "Epic Deck" system occurs shall be compatible for use with this system, "Epic Deck" is by Epic Metals Corporation. See Architectural and Structural drawings for locations. Do not install any conduit directly attached to any roof system, including the 'Epic Deck'.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

E. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
   2. Where cable tray, conduit, wireway, and cable penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

F. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition, floor, ceiling and roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
      c. Install type of firestopping material recommended by manufacturer.
   2. Install floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
   3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
   4. Interior partitions: Seal pipe penetrations at computer rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches (87 mm) thick and extending 4 inches (150 mm) beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install chrome plated steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. General Conditions: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 26 05 29

SECTION 26 05 30 – SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

A. Structural design and calculations for major equipment anchoring, conduit support, and bracing details.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

1.3 REFERENCES

A. International Building Code, 2018

1.4 CODE INFORMATION

A. This project is subject to the seismic bracing requirements of the International Building Code, 2018 edition. The following criteria are applicable to this project.

1. See Sheet S001 Design Criteria for requirements.

B. It is recommended that the contractor enlist the services of a qualified seismic bracing vendor/supplier. Provide bracing for identified equipment and system.

C. Resistance to lateral forces induced by earthquakes shall not be accomplished with consideration of friction resulting from gravity loads. The following companies are listed as resources for the Contractor to consider for obtaining competent assistance regarding the seismic bracing of mechanical piping and equipment. Since seismic constraint is not a common mechanical or electrical requirement for projects and considering that the requirements are specific and include technical expertise, this information may be helpful.

1. Amber Booth
2. Cooper B-Line
3. Mason Industries
4. Tolco (Division of Nibco)

1.5 SUBMITTALS

A. Shop Drawings: Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction. Seismic Bracing Submittals shall be sent with associated equipment prior to installation of any equipment.

1. Lighting Fixtures in Buildings.

2. Equipment Requirements.

B. Product Data:

1. Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer in the State of Nevada and shall verify the capability of structural members to which bracing are attached for carrying the load from the brace. Structural seismic calculations for equipment anchorage for major equipment shall be included.

2. Contractor Designed Bracing: Copies of the Design Calculations with the Drawings. Calculations shall be approved, certified, stamped and signed by a Registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing are attached for carrying the load from the brace.

C. Include Seismic Certification for major equipment.

1. Light Fixtures.
2. Transformers.
3. Switchboards.
4. Panelboards.

1.6 QUALIFICATION

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five years. When requested by the engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic qualified equipment as follows:
The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the 2018 International Building Code (IBC) Site Classification D. The site coefficients Fa=1.0, and spectral response accelerations of Ss=1.999g, S1=0.649g are used. The test response spectrum shall be based upon a 5% damping factor, and a peak (Sds) of at least 1.05g's (3-12 Hz) applied at the base of the equipment in the horizontal direction. The forces in the vertical direction shall be at least 66% of those in the horizontal direction. The tests shall cover a frequency range from 1 to 100Hz. Guidelines for the installation consistent with these requirements shall be provided by the equipment manufacturer and based upon testing of representative equipment. Equipment certification acceptance criteria shall be based upon the ability for the equipment to be returned to service immediately after a seismic event within the above requirements without the need for repairs.

1.7 SYSTEM DESCRIPTION

A. The requirements for seismic protection measures described in this section shall be applied to the electrical equipment and systems listed below.

B. Electrical Equipment: Electrical equipment shall include the following items to the extent required on the Drawings or in other sections of these specifications:

1. Light Fixtures.
2. Transformers.
3. Switchboards.
4. Panelboards.
5. Cable Tray.

C. Electrical Systems: The following electrical systems shall be seismically protected in accordance with this specification: Lighting, power, security, communications and fire alarm.

D. Conduits Requiring No Special Seismic Restraints: Seismic restraints may be omitted from electrical conduit less than 2-1/2 inches trade size. All other interior conduit, shall be seismically protected as specified.

1.8 EQUIPMENT REQUIREMENTS

A. Rigidly Mounted Equipment: Constructed and assembled to withstand the seismic forces in accordance with IBC 2018. Each item of rigid electrical equipment shall be entirely located and rigidly attached on one side only of a building expansion joint. Piping, electrical conduit, etc., which cross the expansion joint shall be provided with flexible joints that are capable of accommodating displacements equal to the full width if the joint in both orthogonal directions.

PART 2 – PRODUCTS

2.1 LIGHTING FIXTURE SUPPORTS

A. Lighting fixtures and supports shall conform to UL 1570, UL 1571, UL1572, UL1573 or UL1574 as applicable.

PART 3 – EXECUTION

3.1 SWAY BRACES FOR CONDUIT

A. Sway bracing materials shall consist of rods, plates, angles, etc.

3.2 LIGHTING FIXTURES IN BUILDINGS

A. Pendant Fixtures: Per manufacturer’s mounting requirements and details on plans.

1. Pendent fixtures shall be attached to structure with a mounting system designed to support 1.4 times the weight of the fixture both vertically and laterally. The connection to structure shall allow a 360-degree range of motion in the horizontal plane (ball and socket).

B. Ceiling Attached Fixtures:

1. Recessed LED Fixtures: Recessed individual or continuous- row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system built in

accordance with the ASTM E 580. Recessed lighting fixtures not over 56 pounds in weight may be supported by and attached directly to the ceiling seismic design. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

2. Surface-Mounted LED Fixtures: Surface-mounted LED individual or continuous-row fixtures shall be attached to a seismic-restraint ceiling support system built in accordance with ASTM E 580.

C. Assembly Mounted on Outlet Box: A supporting assembly, that is intended to be mounted on an outlet box, shall be designed to accommodate mounting features on 4-inch boxes, plaster rings, and fixture studs.

D. Wall-Mounted Emergency Light Unit: Attachments for wall-mounted emergency light units shall be designed and secured for the worst expected seismic disturbance at the site.

3.3 ANCHOR BOLTS

A. Cast-In-Place: Floor or pad mounted equipment shall use cast-in-place anchor bolts or Hilti HDA anchors as indicated. One nut shall be provided on each bolt. Anchor bolts shall conform to ASTM F 1554, Grade 36. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

B. Expansion or Chemically Bonded Anchors: Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided verify the adequacy of the specific anchor and application. Expansion of chemically bonded anchors shall not be used to resist pull-out in overhead and wall installations.

3.4 RESILIENT VIBRATION ISOLATION DEVICES

A. Where the need for these devices is determined, based on the magnitude of the design seismic forces, selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS, except that an equipment weight equal to three times the actual equipment weight shall be used.

3.5 SWAY BRACES FOR CONDUIT 2-1/2” TRADESIZE AND GREATER

A. Sway braces shall be provided to prevent movement of the conduits under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other sections of these specifications.

B. Transverse Sway Bracing: Install transverse sway bracing for steel and conduit. All runs (length of pipe between end joints) shall have a minimum of two transverse braces.

C. Longitudinal Sway Bracing: Longitudinal sway bracing shall be provided at 40 foot intervals unless otherwise indicated. All runs (length of conduit between end joints) shall have one longitudinal brace minimum. Branch lines, walls, or floors shall not be used as sway braces.

D. Vertical Runs: Run is defined as length of pipe between end joints. Vertical runs of conduit shall be braced at not more than 10-foot vertical intervals. Braces for vertical runs shall be above the center of gravity of the segment being braces. Sway braces shall not be used as sway braces.

E. Clamps and Hangers: Clamps or hangers in conduits shall be applied directly to conduit.

F. Anchor Rods, Angles, and Bars: Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure in the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

3.6 EQUIPMENT SWAY BRACING

A. Suspended Equipment: Equipment sway bracing shall be provided for items supported from overhead structural systems. Braces shall consist of angles, rods, bars, or pipes and secured at both ends with not less than ½-inch bolts. Sufficient braces shall be provided for equipment to resist a horizontal force equal to three times the weight of equipment without exceeding safe working stress of bracing components. Details of equipment bracing shall be submitted for acceptance. In lieu of bracing with vertical supports, these items may be supported and braced with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

B. Floor or Pad Mounted Equipment:

1. Shear Resistance: Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

2. Overturning Resistance: The ratio of the overturning moment from seismic forces to the resisting moment due to gravity loads shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. Calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

END OF SECTION 26 05 30

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.

B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system. Exposed junction/pull boxes are not acceptable in finished areas, pull/spare boxes shall be above ceilings and hidden from view. All pull boxes shall be accessible.

B. Underground: Provide schedule 40 PVC. Provide pre-cast concrete or nonmetallic handholes, vaults or manholes.

C. In or Under Slab on Grade: Under slab on grade provide PVC conduit. Minimum size ¾" conduit. Conduit not allowed to be run within slab on grade.

D. Outdoor Locations, Above Grade: Provide electrical metallic tubing. Where exposed to physical damage and heavy moisture (including roof tops) use rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.

E. In or Under Slab on Grade: Under slab on grade provide PVC conduit. Minimum size ¾" conduit. Do not group/bundle conduits under vapor barrier. Conduits under the building slab shall be dispersed in congested areas. Routing shall be reviewed by Structural Engineer prior to vapor barrier installation. Where conduits cross under the slab, they shall be separated by base/soil material acceptable to Structural Engineer. Conduit not allowed to be run within slab on grade.

F. Interior Wet Locations: Provide rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

G. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

H. Exposed Dry Locations: Provide electrical metallic tubing, except where exposed to physical damage; provide rigid steel conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes. Exposed conduit in finished areas not acceptable. Exposed conduit shall be kept to a minimum in all cases, and approved by the owner prior to rough-in or installation in areas where exposed conduit will be installed by the Contractor.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 1/2inch (13mm) unless otherwise specified. Comply with NEC for minimum size conduit and installation requirements. Minimum size 1/2 inch diameter for branch circuits, minimum size 3/4 inch diameter for homeruns. Minimum size for PVC conduit shall be 3/4 inch in diameter. Conduits shall be installed complete end-to-end prior to installing conductors.

1.5 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit for the following:
1. Flexible metal conduit.
2. Liquidtight flexible metal conduit.
3. Nonmetallic conduit.
4. Raceway fittings.
5. Conduit bodies.
6. Surface raceway.
7. Wireway.
8. Pull and junction boxes.
9. Handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents:
1. Record actual routing of conduits 2” and larger.
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Product storage and handling requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. General Conditions: Coordination and project conditions.

B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings and Conduit Bodies: NEMA FB 1; all steel fittings. Threadless fittings shall not be used.

D. Terminate rigid conduit in dry locations with two steel locknuts, one inside, one outside of the cabinet, junction box or outlet box and an insulated bushing. Bushings shall be malleable iron or steel with smooth insulating ring molded into edge of bushing to prevent damage to cable. Insulated bushings shall be 150 degree C self extinguishing thermoplastic. Provide grounding bushings on 1 ½ inch conduit and larger. Construction of bushings shall be similar to steel bushings described above except provide lugs for grounding connection.

E. Where conduits are installed underground, the threaded joints shall be sealed with a conductive joint sealing compound.

2.2 PVC COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil (0.05 mm) thick.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction.

B. Fittings: NEMA FB 1.

C. Connectors and fittings galvanized steel, threadless type with insulated throats, U.L. approved for grounding means.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC jacket.

B. Fittings: NEMA FB 1.

C. Fitting Assembly – Sealing type, with steel gland, nylon ring and ground cone inside locknut. All fittings with insulated throat, U.L. approved for grounding means.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; use insulated throat galvanized steel, rain tight, compression or set screw type. Compression type must be used in all medical facilities and in damp locations. Provide grounding bushing on 1¼ inch and larger. **Zinc alloy and similar soft metal castings are not allowed.**

2.6 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 PVC. Minimum sizes shall be 3/4 inch by diameter.

B. Fittings and Conduit Bodies: NEMA TC 3.

C. Fittings same material as conduit and installed with watertight joint compound recommended by manufacturer.

2.7 WIREWAY

A. Product Description: NEMA Type 1, General purpose, Oiltight and dust-tight. NEMA Type 3R, raintight type wireway as required to meet project conditions. Open top assembly.

B. Knockouts: NEMA Type 1, Manufacturer's standard. NEMA Type 3R – none.

C. Size: As indicated on Drawings.

D. Cover: NEMA Type 1 – removable hinged cover latches with captive screws. NEMA Type 3R – removable cover with quick release latches and full gaskets.

E. Connector: Slip-in.

F. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

G. Finish: Rust inhibiting primer coating with gray enamel finish.

2.8 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch (13 mm) male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Furnish gasketed cover by box manufacturer.

C. Wall Plates for Finished Areas: As specified in Section 26 27 26.

D. Wall Plates for Unfinished Areas: Galvanized industrial raised rings suitable for device type.

2.9 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 27 16.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. Flush pull boxes installed in walls shall have oversized covers and be painted to match surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION – RACEWAY

A. Electrical conduits shall be run concealed where building construction allows. Any exposed conduit shall be approved by the owner or architect prior to installation. Any exposed conduit, fittings, supports, etc shall be painted to match the surface on which they are installed.

B. Conduit within the roof deck assembly shall be installed in accordance with NEC 300.4(E) and (F). Utilize Galvanized Rigid Conduit (GRC), or Intermediate Metallic Conduit (IMC) with steel plates to protect junction boxes from roof insulation attachment anchors.

C. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

D. Arrange raceway supports to prevent misalignment during wiring installation.

E. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

F. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

G. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

H. Do not attach raceway to ceiling support wires or other piping systems.

I. Construct wireway supports from steel channel specified in Section 26 05 29.

J. Route exposed raceway parallel and perpendicular to walls.

K. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

L. Route conduit in and under slab from point-to-point.

M. Maintain clearance between raceway and piping for maintenance purposes.

N. Maintain 12 inch (300 mm) clearance between raceway and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

O. Cut conduit square using saw or pipe cutter; de-burr cut ends.

P. Bring conduit to shoulder of fittings; fasten securely.

Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

R. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

S. Install no more than equivalent of three 90 degree bends (270 degrees total) between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.

T. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

U. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

V. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

W. Surface Wireway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

X. Close ends and unused openings in wireway.

Y. Use rigid metal conduit or PVC coated rigid steel conduit on all through slab transitions. Use rigid metal conduit elbows 2-lap wrapped with 20mil 3M Scotch wrap or tape or PVC coated rigid steel conduit on all underground/underslab raceways 2 inches and larger.

Z. Exterior buried conduit shall be schedule 40 PVC with PVC coated RGS 90 degree bends.

AA. Use rigid steel conduit for all motor circuits where subject to physical damage.

BB. Intermediate grade metal conduit, (threaded only), may be used in lieu of rigid steel conduit where allowed by NEC.

CC. Use flexible steel conduit for:
1. Connection to vibrating equipment in dry locations between rigid conduit and connection box on equipment.
2. Final connections to equipment in dry locations.
3. Final connections to equipment requiring adjustments.

4. Final connections to recessed lighting fixtures from conduit system.
5. Connection to distribution transformers.
6. Maximum length 6'.

DD. Use Liquidtight flexible conduit in damp or wet locations for same circuit categories listed for flexible conduit above. Engineer will determine "damp or wet" locations if questionable.

EE. EMT shall not be installed underground and shall not be encased in concrete.

FF. Conduit must be installed high enough above lay in ceiling to permit removal of ceiling panels and light fixtures.

GG. In concrete slab on grade or elevated slabs: Conduit may penetrate slabs but will **NOT** be allowed to run in slabs on grade or elevated slabs.

HH. In accordance with NEC 300.4 conduit may not be run exposed across roof.

II. Due to the corrosive nature of the soil all metal conduit, couplings, elbows and fittings in contact with the soil or buried below grade shall be factory coated with PVC or two-lap wrapped with 20 mil 3M Scotchwrap with Pipe Primer applied as recommended by Manufacturer. Make underground conduit fittings watertight using conductive compound tape. Do not use split couplings and similar fittings underground and exposed to moisture.

JJ. Route underground conduits minimum 24" below grade.

KK. Paint conduit threads exposed to moisture with exterior grade, rust preventive silver paint after installation.

LL. Where conduit crosses expansion joints, install expansion type fittings with bonding jumper. Use expansion joint with lateral conduit movement of 4" or 8" as indicated. When both vertical and lateral movement is expected the joint shall be a 1" braided flexible coupling allowing both directional movements.

MM. Vibrating equipment and equipment requiring adjustment, i.e.: motors, transformers, etc: make final connections with flexible metal conduit.

NN. Isolate conduit connections to equipment on roof from roof penetration of conduit with short section of liquid-tight flexible conduit between roof penetration and equipment to prevent leak in roof penetration due to equipment vibration.

OO. Supports shall be installed in accordance with Seismic standards. Provide necessary side braces and swing joints as required. See Spec Section 26 05 30 Seismic Protection for Electrical Equipment.

PP. All conduit penetrations through or within CMU walls shall be rigid steel. Conduit run within CMU walls encased in concrete shall be PVC. All conduit penetrations (floors, walls, slab on grade, roofing) shall be made watertight with a joint sealant compound.

3.4 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches (150 mm) separation (non-rated or acoustically rated). Install with minimum 24 inches (600 mm) separation in fire-rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

P. Seal boxes during construction to prevent entrance of construction debris.

Q. Paint wiring connections in ground mounted outlets or floor outlets in wet locations with “Scotchkote” and fill box with “Duxseal”.

R. Refer to structural details regarding installation of boxes and conduit within CMU walls and adjacent to openings. All boxes and conduit must maintain minimum spacing requirements per structural details.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. General Conditions: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION 26 05 33

SECTION 26 05 53 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide and install required identification for the systems and equipment shown on the drawings and/or specified. The extent of identification is specified herein and in individual technical sections of work.

B. Coordinate with Consultant and Owner for proper equipment identification nomenclature. Nameplates must be approved by Consultant prior to ordering and installation.

C. Types of electrical identification include:
1. Conduit labeling.
2. Buried cable and conduit warnings.
3. Cable/conductor identification.
4. Operational instructions and warnings.
5. Danger signs.
6. Equipment/system identification labels and signs.
7. Device plate labeling.
8. Junction box labeling.

1.2 RELATED WORK

A. Painting of conduit and color-coded painting of conduit if required. See Division 9.

1.3 SUBMITTALS

A. Manufacturer's Data
1. Product specifications and installation instructions for each material and device.

B. Samples
1. Provide for each color, lettering style and other graphic representation.

C. Labels
1. Provide a list of labels with actual designations as they will be printed.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIAL

Conform to ANSI A13.1, Table 3 for minimum size of legend letters and minimum length of color field for each raceway or cable size. Use colors prescribed by ANSI A13.7, NFPA 70 and these specifications.

A. Color-Coded Conduit Markers
1. Manufacturer's standard preprinted, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360 degrees around conduits. Attach with adhesive, adhesive lap joint of marker, matching adhesive plastic tape at each end of marker, or pre-tensioned snap-on. Lettering to indicate voltage, function of conductors in conduit and shall be 8" minimum length (i.e. ac power, dc power, fire alarm).

B. Color-Coded Plastic Tape

1. Manufacturer's standard self-adhesive vinyl tape, minimum 3 mils thick by 1-1/2" wide.
2. Color: Orange.

C. Underground Plastic Line Marker
1. Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, for direct-burial service; minimum 4" wide x 4 mils thick. Printing to indicate type service of cable; with large (minimum 2-1/2") high letters.

D. Cable/Conductor Identification Bands
1. Manufacturer's standard vinyl self-adhesive self laminating cable/conductor markers, wrap-around type; pre-numbered plastic coated, or write-on type with clear plastic self-adhesive cover flap, lettered to show circuit identification. Similar to Panduit "Instacode" or accepted equivalent by T&B, or Tyton. Refer to Section 26 05 19 Low Voltage Electrical Power Conductors and Cables.

E. Self-Adhesive Plastic Signs
1. Manufacturer's standard, self-adhesive, pre-printed, flexible vinyl signs for operational instructions or warnings. Sizes suitable for application and visibility, with proper wording for application.
2. Color: Orange or Yellow with black lettering.

F. Danger Signs
1. Manufacturer's standard "DANGER" signs, baked enamel finish on 20 gage steel; standard red, black and white graphics; 14" x 10" unless 10" x 7" is largest which can be applied, or where larger size is needed for visibility use recognized explanation wording (as examples: HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH, DANGER-STARTS AUTOMATICALLY).

G. Engraved Signs (Nameplates)
1. Use 1/8" thick melamine plastic laminate, complying with FS LP-387, sizes as indicated, engrave with standard letter style of sizes and wording indicated (1/4" letters minimum).
2. Color: Black field with white letters for normal power service;
3. Fasteners: Self adhesive backing or double stick tape.

H. Permanent Polyester Tape:
1. Use Permanent Metalized Polyester Tapes for Industrial purposes that are resistant to oil, solvents and chemicals, these durable tapes adhere to all surface.
2. DYMO #18485, Black on Silver, 3/8” wide, or equivalent.

I. Lettering and Graphics
1. Coordinate names, abbreviations and other designations used with those shown or specified. Provide numbers, lettering, and wording as indicated or required for identification and operation/maintenance.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements
1. Install after completion of painting.
2. Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification

1 Use adhesive marking tape labels, Brother or Kroy labels 1" high x 12" long (min.), at 20 foot intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible. Labels for multiple conduits shall be aligned. Use the following colors:
   a. Above 600 Volts: Conduit 2” and larger - Black letters on orange background indicating feeder identification and voltage. Feeders within walls: provide identification on wall surfaces directly external to the conduits. Alternate identification labels with "DANGER - HIGH VOLTAGE" warning signs of the same color.
   b. 600 Volt and Below Normal: Conduit 2” and larger - White letters on black background indicating feeder identification and voltage. Not required unless otherwise noted.
   c. 600 Volt and Below Emergency: All conduit - White or black letters on red background indicating feeder identification and voltage. Not required unless otherwise noted
   d. 600 Volt and Below UPS: All conduit - Black letters on yellow background indicating feeder identifications, circuit number and voltage. Not required unless otherwise noted
   e. Fire Alarm: All conduit shall be manufactured red.
   f. Temperature Control: White or black letters on blue background indicating "TEMP. CONTROL"
   g. Ground: All conduit - White or black letters on green background
   h. Network Fiber: All conduit - Black letters on white background indicating "NETWORK FIBER."
2. Where conduits enter or exit a panelboard, pull or junction box, switchboard, or other distribution equipment, conduit labels shall include circuit number in addition to feeder identification and voltage.
3. For overhead conduits, place identification such that it can be read standing on the floor below.

C. Underground Cable Identification
1. During back-filling of underground cable, install continuous underground marker, directly over buried line 6" to 8" below finished grade. Where multiple lines are buried in common trench not exceeding 24" width, install a single line marker. Install additional line markers for each increment of 24” width, i.e., 36” wide trench - 2 markers; 54” wide trench, 3 markers. Install multiple markers evenly spaced.
2. Install line marker for every buried ductbank and/or conduits 3" diameter or larger.
3. Electric Lines: Use red colored tape with lettering stating “CAUTION BURIED ELECTRIC LINE BELOW”.
4. Communication Lines: Use orange colored tape with lettering stating “CAUTION COMMUNICATION LINE BELOW”.

D. Operational Identification and Warnings
1. Provide operational signs for:
   a. Switchgear
   b. Large motor starters
   c. All rotating equipment

E. Danger Signs
1. Provide as required by codes.

F. Engraved Plastic Laminated Signs
1. Install on each major unit of electrical equipment in the building. Provide single line of text, 1/4" high lettering on 1" high sign (1-1/2" high where 2 lines required). Matching terminology and numbering as indicated in contract documents.

2. Provide signs for each unit of the following categories:
   a. Electrical cabinets and enclosures: Indicate cabinet designation, voltage, phase and feeder origin.
   b. Access panel/doors to electrical facilities: Indicate room name and use.
   c. Major electrical switchgear: Indicate equipment designation, voltage, phase and feeder origin.
   d. Electrical substations: Indicate equipment designation, voltage, phase and feeder origin.
   e. Safety switches, circuit breakers and portable engine disconnects: Indicate equipment designation, voltage, phase, feeder origin and circuit number.
   f. Transformers: Indicate transformer designation, voltages, phases, feeder origin, circuit number and equipment served.
   g. Feeder cables inside pull and junction boxes and inside all switchgear at terminals indicating source and destination: Fasten with nylon ties.
   h. All equipment furnished in this Division of the specifications: Indicate equipment designation, voltage, phase, feeder origin and circuit number.

G. Install signs where indicated or most visible. Secure with at least two cadmium-plated screws. Where substrate cannot receive screws, use industrial epoxy cement to secure signs. Self-adhesive or double stick tape is acceptable. Secure with cadmium plated screws on porous surfaces.

H. Identify all conduits installed for future use.

I. Junction, Pull and Connection boxes. Identification of systems and circuits shall indicate system voltage and identity of contained circuits on outside of box cover. Color code shall be same as conduits for pressure sensitive labels. Use self-adhesive marking tape labels at exposed locations and indelible black marker at concealed boxes. All fire alarm boxes shall have red covers. All temperature control boxes shall have blue covers.

J. Branch Circuit Conductors shall be identified in each junction box and pull box with wire markers as manufactured by T & B, Panduit, 3M or Ideal to indicate panel/circuit number.

K. Junction Boxes in branch circuit wiring shall be labeled with panel and circuit numbers. Junction boxes for special systems shall be labeled with system name and other identification as directed; for example, “fire alarm-zone 1”. Where boxes are installed flush mounted in finished areas or surface mounted in unfinished areas, labeling shall be with engraved plastic nameplate as specified herein. Where boxes are installed above accessible ceilings, labeling may be neat hand written lettering with indelible marker.

L. Device Plates – switches and receptacles. Identify the panelboard and branch circuit number from which served on the front of the device plate with Permanent Polyester Clear Tape with black letters. Locate all labels at the bottom of the plate in the same location throughout.

END OF SECTION 26 05 53

SECTION 26 05 73.13 - SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Computer-based, fault-current study to determine minimum interrupting capacity of circuit protective devices.

B. Related Requirements:

1. Section 26 05 73.16 "Coordination Studies" for overcurrent protective device coordination studies.
2. Section 26 05 73.19 "Arc-Flash Hazard Analysis" for arc-flash studies.

1.2 STUDY SCOPE

1. Study shall encompass all portions of electrical distribution system from normal power source and/or standby sources up to and including breakers in service entrance switchboard, main breaker in sub-distribution panels, main breaker in each panelboard, etc.
2. For existing systems, the scope of the study must include the point where modifications are made and all upstream branches of the distribution system back to the service entrance utility point of connection, even if not being modified by this project.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items must remain functional throughout construction period.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

F. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. For power system analysis software to be used for studies.

B. Short-Circuit Study Report:

1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form.

a. Short-circuit study input data, including completed computer program input data sheets.
b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Engineer for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
c. Revised one-line diagram, reflecting field investigation results and results of short-circuit study or updates required based on data collected for the study.
d. Study report shall include documentation of all equipment data used in the short-circuit and equipment duty analysis.
e. Study shall include a detailed listing of any electrical equipment found to be underrated for the calculated fault duty.

C. Closeout Submittals:

1. Provide one (1) hard copy of the oneline diagram in a tube to be magnetically attached to the side of the service entrance.

2. Provide two (2) digital (CD or USB) copies of the study model in the native format for which it was created (SKM, EasyPower, ETAP). One shall be magnetically attached to the side of the service entrance and the other shall be given to the Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Product Data:

1. Submit information on computer software program to be used for studies.

2. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

B. Qualification Data:

1. For Power Systems Analysis Software.
2. For Power System Analysis Specialist.
3. For Power System Field Adjusting Agency.

1.6 CLOSEOUT SUBMITTALS

A. Final Report:
1. Final one-line diagram

2. Final short-circuit study report
3. Short-circuit data files

1.7 QUALITY ASSURANCE

A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms must comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.
1. Power System Analysis Software Qualifications: Computer program shall be designed to perform ANSI and IEC based short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.

D. Power Systems Analysis Specialist Qualifications: Professional Engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this Professional Engineer.

E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed by Power Systems Analysis Specialist.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE

A. Comply with IEEE 399 and IEEE 551.

B. Analytical features of power systems analysis software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program must be capable of plotting and diagramming time-current-characteristic curves as part of its output.

D. Computer program must be designed to perform short-circuit studies or have function, component, or add-on module designed to perform short-circuit studies.

E. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

F. Manufacturers:
1. SKM Systems Analysis, Inc.
2. EasyPower, LLC
3. ETAP

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kVA and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. Derating factors and environmental conditions.
7. Any revisions to electrical equipment required by study.

D. Comments and recommendations for system improvements or revisions in written document, separate from one-line diagram.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600 V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data:

1. One-line diagram of system being studied.
2. Power sources available.
3. Manufacturer, model, and interrupting rating of protective devices.
4. Conductors.
5. Transformer data.

G. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.

c. Fault-point X/R ratio.
d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain data necessary for conduct of study.

1. Verify completeness of data supplied on one-line diagram. Call discrepancies to Engineer’s attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers in accordance with NFPA 70E.

B. Gather and tabulate required input data to support short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to amount of detail that is required to be acquired in field. Field data gathering must be under direct supervision of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.

6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

3.2 SHORT-CIRCUIT STUDY

A. Perform study following general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Begin short-circuit current analysis at service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment supplied by single transformer smaller than 75 kVA.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. Include ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

G. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.

H. Include in report identification of protective device applied outside its capacity.

END OF SECTION 26 05 73.13

SECTION 26 05 73.16 - COORDINATION STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

    a. Study results must be used to determine coordination of series-rated devices.

B. Related Requirements:

1. Section 260573.13 "Short-Circuit Studies" for fault-current studies.
2. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash studies.

1.2 STUDY SCOPE

1. Study shall encompass all portions of electrical distribution system from normal power source and/or standby sources up to and including breakers in service entrance switchboard, main breaker in sub-distribution panels, main breaker in each panelboard, etc.
2. For existing systems, the scope of the study must include the point where modifications are made and all upstream branches of the distribution system back to the service entrance utility point of connection, even if not being modified by this project.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. Existing to remain items must remain functional throughout construction period.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when abnormal current flow exists and then removes the affected portion of the circuit from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

F. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. For power system analysis software to be used for studies.

B. Coordination Study Report:

1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form.

a. Coordination-study input data, including completed computer program input data sheets.
b. Study and equipment evaluation reports.
c. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
d. Revised one-line diagram, reflecting field investigation results and results of coordination study.

C. Closeout Submittals:

1. Provide one (1) hard copy of the oneline diagram in a tube to be magnetically attached to the side of the service entrance.

2. Provide two (2) digital (CD or USB) copies of the study model in the native format for which it was created (SKM, EasyPower, ETAP). One shall be magnetically attached to the side of the service entrance and the other shall be given to the Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

B. Qualification Data:

1. For Power Systems Analysis Software.
2. For Power System Analysis Specialist.
3. For Power System Field Adjusting Agency.

1.6 QUALITY ASSURANCE

A. Studies must be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms must comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE

A. Comply with IEEE 242 and IEEE 399.

B. Analytical features of device coordination study computer software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program must be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program must report device settings and ratings of overcurrent protective devices and must demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

D. Computer program must be designed to perform coordination studies or have function, component, or add-on module designed to perform coordination studies.

E. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

F. Manufacturers:
1. SKM Systems Analysis, Inc.
2. EasyPower, LLC
3. ETAP

2.2 COORDINATION STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kVA and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.
6. Revisions to electrical equipment required by study.
7. Study Input Data: As described in "Power System Data" Article.

a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

D. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in field. Use manufacturer's data sheets for recording recommended setting of overcurrent protective devices when available.

    a. Phase and Ground Relays:

        1) Device tag.
        2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
        3) Recommendations on improved relaying systems, if applicable.

    b. Circuit Breakers:

        1) Adjustable pickups and time delays (long time, short time, and ground).
        2) Adjustable time-current characteristic.
        3) Adjustable instantaneous pickup.
        4) Recommendations on improved trip systems, if applicable.

    c. Fuses: Show current rating, voltage, and class.

E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for switching schemes and for emergency periods where power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying portion of system covered.
2. Terminate device characteristic curves at point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
3. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

    a. Power utility's overcurrent protective device.
    b. Medium-voltage equipment overcurrent relays.
    c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    f. Cables and conductors damage curves.
    g. Ground-fault protective devices.
    h. Motor-starting characteristics and motor damage points.
    i. Generator short-circuit decrement curve and generator damage point.
    j. Largest feeder circuit breaker in each motor-control center and panelboard.

5. Maintain selectivity for tripping currents caused by overloads.
6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7. Provide adequate time margins between device characteristics such that selective operation is achieved.
8. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Obtain data necessary for conduct of overcurrent protective device study.

1. Verify completeness of data supplied in one-line diagram on Drawings. Call discrepancies to Architect's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers must be in accordance with NFPA 70E.

B. Gather and tabulate required input data to support coordination study. List below is guide. Comply with recommendations in IEEE 551 for amount of detail required to be acquired in field. Field data gathering must be under direct supervision of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.

13. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
17. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for condition where available fault current is greater than interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.3 COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. Base study on device characteristics supplied by device manufacturer.

D. Begin analysis at service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. Transformer Primary Overcurrent Protective Devices:

1. Device must not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings must protect transformers according to IEEE C57.12.00, for fault currents.

G. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

H. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands maximum short-circuit current for time equivalent to tripping time of primary relay protection or total clearing time of fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

I. Generator Protection: Select protection according to manufacturer's instructions and to IEEE 242.

J. Include ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

K. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.

L. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Application of series-rated devices must be recertified, complying with requirements in NFPA 70.
4. Include in report identification of protective device applied outside its capacity.

3.4 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform load-flow and voltage-drop study to determine steady-state loading profile of system. Analyze power system performance two times as follows:

1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load flow and voltage drop based on 80 percent of design capacity of load buses.

3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.5 MOTOR-STARTING STUDY

A. Perform motor-starting study to analyze transient effect of system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze effects of motor starting on power system stability.

B. Prepare motor-starting study report, noting light flicker for limits proposed by IEEE 141 and voltage sags so as not to affect operation of other utilization equipment on system supplying motor.

3.6 FIELD ADJUSTING

A. Adjust relay and protective device settings according to recommended settings provided by coordination study. Field adjustments must be completed by engineering service division of equipment manufacturer under "Startup and Acceptance Testing" contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting must be by qualified medium-voltage and low-voltage electrical testing and inspecting agency.

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS & MTS. Certify compliance with test parameters. Perform NETA tests and inspections for adjustable overcurrent protective devices.

END OF SECTION 26 05 73.16

SECTION 26 05 73.19 - ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Computer-based, arc-flash study to determine arc-flash hazard distance and incident energy to which personnel could be exposed during work on or near electrical equipment.

B. Related Requirements:

1. Section 260573.13 "Short-Circuit Studies" for fault-current studies.
2. Section 260573.16 "Coordination Studies" for overcurrent protective device coordination studies.

1.2 STUDY SCOPE

1. Study shall encompass all portions of electrical distribution system from normal power source and/or standby sources up to and including breakers in service entrance switchboard, main breaker in sub-distribution panels, main breaker in each panelboard, etc.
2. For existing systems, the scope of the study must include the point where modifications are made and all upstream branches of the distribution system back to the service entrance utility point of connection, even if not being modified by this project.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. p.u.: Per unit. The reference unit, established as a calculating convenience, for expressing all power system electrical parameters on a common reference base.

E. SCCR: Short-circuit current rating.

F. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

G. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. For power system analysis software to be used for studies.

B. Study Submittals:

1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form:

a. Arc-flash study input data, including completed computer program input data sheets.
b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
c. Revised one-line diagram, reflecting field investigation results and results of arc-flash study.

C. Closeout Submittals:

1. Provide one (1) hard copy of the oneline diagram in a tube to be magnetically attached to the side of the service entrance.

2. Provide two (2) digital (CD or USB) copies of the study model in the native format for which it was created (SKM, EasyPower, ETAP). One shall be magnetically attached to the side of the service entrance and the other shall be given to the Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 QUALITY ASSURANCE

A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms must comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Comply with IEEE 1584 and NFPA 70E.

B. Analytical features of device coordination study computer software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer program must be designed to perform arc-flash analysis or have function, component, or add-on module designed to perform arc-flash analysis.

D. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Manufacturers:
1. SKM Systems Analysis, Inc.
2. EasyPower, LLC
3. ETAP

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kVA and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

G. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in report:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce 3.5 by 5 inch (76 by 127 mm) self-adhesive equipment label for each work location included in analysis.

B. Label must have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.
    a. Arc-flash boundary.
    b. Restricted approach boundary.
    c. Limited approach boundary.
4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels must be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies: Perform Short-Circuit and Protective Device Coordination study studies prior to starting Arc-Flash Hazard Analysis.

1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation must assume maximum contribution from utility and must assume motors to be operating under full-load conditions.
2. Calculate arc-flash energy at 85 percent of maximum short-circuit current in accordance with IEEE 1584 recommendations.
3. Calculate arc-flash energy with utility contribution at minimum and assume no motor contribution.

D. Calculate arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment fed from transformers smaller than 75 kVA.

F. Calculate limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must take into account changing current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:

1. Fault contribution from induction motors must not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).

H. Arc-flash energy must generally be reported for maximum of line or load side of circuit breaker. However, arc-flash computation must be performed and reported for both line and load side of circuit breaker as follows:

1. When circuit breaker is in separate enclosure.
2. When line terminals of circuit breaker are separate from work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain data necessary for conduct of arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.

2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

A. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to amount of detail that is required to be acquired in field. Field data gathering must be under direct supervision of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

B. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
1. Obtain electrical power utility impedance or available short circuit current at service.
2. Power sources and ties.
3. Short-circuit current at each system bus (three phase and line to ground).
4. Full-load current of loads.
5. Voltage level at each bus.
6. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
7. For reactors, provide manufacturer and model designation, voltage rating and impedance.
8. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
9. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
10. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
11. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
12. Motor horsepower and NEMA MG 1 code letter designation.
13. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
14. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.4 LABELING

A. Apply one arc-flash label on front cover of each section of equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below not fed by single transformer smaller than 75 kVA must have arc-flash label applied to it:

1. Low-voltage switchgear.
2. Switchboards.
3. Panelboards.
4. Motor-control centers.
5. Low voltage transformers.

6. Safety switches.
7. Control panels.

C. Note on record Drawings location of equipment where personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under direct supervision and control of qualified electrical professional engineer.

END OF SECTION 26 05 73.19

SECTION 26 09 23 – LIGHTING CONTROL DEVICES AND DLM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Distributed Digital Lighting Control System: System includes
   1. Digital Lighting and Plug Load Controls
   2. Relay Panels
   3. Emergency Lighting Control.

1.2 RELATED SECTIONS

A. Section 26 51 00 - Lighting.

B. Section 26 56 00 - Exterior Lighting.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

B. NEMA - National Electrical Manufacturers Association

C. FCC emission standards

D. UL - Underwriters Laboratories, Inc. Listings

E. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.

F. UL 20 - General Use Switches, Plug Load Controls

G. UL 924 - Standard for Emergency Lighting and Power Equipment

H. ULC - Underwriter Laboratories of Canada Listings

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.

B. System shall conform to requirements of NFPA 70.

C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

D. System shall be listed under UL sections 916 and/or 508.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Catalog sheets and specifications.
   2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service

condition requirements, and installed features.
3. Storage and handling requirements and recommendations.
4. Installation instructions.
5. Provide physical sample of switches demonstrating faceplate engraving as indicated on plans, as requested.

C. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:
1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
2. Operation and Maintenance Manual:
a. Include approved Shop Drawings and Product Data.
b. Include Sequence of Operation, identifying operation for each room or space.
c. Include manufacturer's maintenance information.
d. Operation and Maintenance Data: Include detailed information on device programming and setup.
e. Include startup and test reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:
1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
2. Review the specifications for low voltage control wiring and termination.
3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:

1. Record minutes of the conference and provide copies to all parties present.
2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
   2. Relative humidity: Maximum 90 percent, non-condensing.

1.10 WARRANTY

A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

1.11 REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS

A. Provide Manufacturer's Remote Access and Enhanced Warranty for Networked Lighting Controls as follows:
   1. Configure to allow the manufacturer remote access to the lighting control system. Configuration includes at a minimum: cellular modem, antenna for the modem, cellular service contract and any connections required to enable communication to the specified Network Lighting Control system.
   2. The Remote Access program will automatically trigger a First Year Enhanced Warranty Agreement that will start once lighting control system startup is complete and accepted by the Owner. During this one year period, the Owners authorized site contact can request the manufacturer to check the system for proper operation, and make any programmable changes desired. Manufacturer shall provide a phone number dedicated to customer calls concerning Remote Accessible systems, and a support organization capable of enabling cellular communication to the system for troubleshooting and making requested changes to the system. Any user attempting to request remote support on the system shall be fully verified by the Remote Operations Center (ROC) before providing remote support or making any changes to the system. Systems that allow the modem to be always accessible will not be acceptable. Access must be by a secured VPN connection to the private lighting control network that is completely isolated from the Owner's internal network. Remote access that requires a connection through the Owner's internal network is not acceptable.
   3. The Remote Access Program may be continued by the Owner after the first year. However, If the Owner does not continue the enhanced warranty the cellular contract will lapse, and all hardware components, while still remaining property of the manufacturer, will remain in situ so that they can be re-activated at a later time should the Owner desire.
   4. The Manufacturer's Remote Access capability shall provide at a minimum the following features:
      a. Ability to provide initial system diagnostics through LMCS Software to detect fault conditions in hardware or connected devices.

b. Access to all devices via LMCS Software allowing for programmability of device features. This will include all scheduling of Time of Day Events and programming of individual device parameters to meet Sequence of Operation requirements.
c. Access to the LMSM Segment Manager browser-based interface (if included on project) to verify it is setup per project documentation, and all functional operations are working properly.
d. On demand access to manufacturer technical support via a Remote Operations Center (ROC) that will provide remote troubleshooting, diagnostics, and configuration/programming assistance.
e. Additional client training and tuning on the Lighting Control System after building occupancy can be performed while remotely connected to the site.

5. Contractor shall coordinate networking/IT/VPN requirements with owner prior to start of system installation. The contractor is required to provide information from the lighting controls supplier as to the individual who is responsible for system startup. Coordinate with WCSD IT department for network access requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: WattStopper, which is located at: 2700 Zanker Rd., Suite 168; San Jose, CA 95134; Tel: 408.988.5331; Fax: 408.988.5373; Web:www.wattstopper.com

B. Substitutions: Acuity, Lutron.

C. With provisions of project general conditions for substitutions.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide a WattStopper, Provide Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.

1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in sequence of operations.
2. Provide additional sensors as required for a complete detection system in the associated space. Detectors shall be located clear of HVAC systems that may generate noise or vibration that would provide false readings in a space. The contractor is responsible for selecting the proper detection device for each space to provide optimal coverage and minimal nuisance to the user. In all cases the manufacturers direction regarding best possible placement shall be followed for optimal detection in each space located, shown or not.
3. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
   a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
   b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
   c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
   d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior

to dimming.

4. Conference, meeting, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
   1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
   2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
   3. Digital Plug Load Controllers: Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
   4. Digital Fixture Controllers: Self-configuring, digitally addressable one relay fixture-integrated controllers for on/off/0-10V dimming control.
   5. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
   6. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
   7. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
   8. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
   9. Digital Lighting Management (DLM) segment network: Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.
   10. Network Bridge: Provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
   11. Segment Manager: BACnet MS/TP-based controller with web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
   12. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
   13. Digital Lighting Management Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.
   14. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

1. Features of the DLM local network include:
   a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
   b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
   c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
   d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 DIGITAL LOAD CONTROLLERS (ROOM, FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features
   1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
   2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
   3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
   4. Device Status LEDs to indicate:
      a. Data transmission
      b. Device has power
      c. Status for each load
      d. Configuration status
   5. Quick installation features including:
      a. Standard junction box mounting
      b. Quick low voltage connections using standard RJ-45 patch cable
   6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
      a. Turn on to 100 percent
      b. Turn off
      c. Turn on to last level
   7. Each load be configurable to operate in the following sequences based on occupancy:
      a. Auto-on/Auto-off (Follow on and off)
      b. Manual-on/Auto-off (Follow off only)
   8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
   9. BACnet object information shall be available for the following objects:

a. Load status
b. Schedule state, normal or after-hours
c. Demand Response enable and disable
d. Room occupancy status
e. Total room lighting and plug loads watts
f. Electrical current
g. Total watts per controller
h. Total room watts/sq ft.
i. Force on/off all loads

10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
    a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
    b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
    c. The following dimming attributes may be changed or selected using a wireless configuration tool:
        1) Establish preset level for each load from 0-100 percent
        2) Set high and low trim for each load
        3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
    d. Override button for each load provides the following functions:
        1) Press and release for on/off control
        2) Press and hold for dimming control
    e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
    f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
    g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
    h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. On/Off Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
2. One or two relay configuration
3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
5. WattStopper product numbers: LMRC-101, LMRC-102

C. On/Off/0-10V Dimming KO Mount Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A total load
2. Optional real time current and voltage monitoring (with - M Monitoring option).
3. One or two relays configurations
4. Smart 150 mA switching power supply

5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
6. One dimming output per relay
    a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting
7. Units capable of providing both Class 1 or Class 2 wiring for the 0-10V output
8. WattStopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M.

D. On/Off/0-10V Dimming Enhanced Room Controllers shall include:
1. Dual voltage 120/277 VAC, 60 Hz capable. 120/277 volt models rated for 20A total load.
2. Built in real time current monitoring.
3. One, two or three relays configurations.
4. Smart 250 mA switching power supply.
5. Four RJ-45 DLM local network ports. Provide integral strain relief.
6. One dimming output per relay
    a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting (LMRC-110 series and 210 series).
7. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213.

E. On/Off/ Forward Phase Dimming Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) rated for 20A total load, with forward phase dimmed loads derating to 16A for some load types
2. Built in real time current monitoring
3. One or two relays configurations
4. Smart 250 mA switching power supply
5. Four RJ-45 DLM local network ports. Provide integral strain relief
6. One dimming output per relay
    a. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-220 series)
7. WattStopper product numbers: LMRC-221, LMRC-222

F. Fixture Controllers shall include
1. A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.
2. One 3A 120/277V rated mechanically held relay.
3. Programmable behavior on power up following the loss of normal power:
    a. Turn on to 100 percent
    b. Turn off
    c. Turn on to last level
4. Requirement for 7 mA of 24VDC operating power from the DLM local network.
5. Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the DLM local network to drive accessory devices.
6. Power to drive the LMFC Fixture Controller electronics can come from any Room or Plug Load Controller, LMPB-100 Power Booster and/or LMZC-301 Zone Controller (described later in the LMCP LIGHTING CONTROL PANELS specification section).
7. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.

8. Connect to a single or dual RJ-45 adaptor with 24 inch leads. Single adaptor mounts in a 1/2 inch KO and dual adaptor in a 2.2 by 1.32 inch rectangular hole for connection to the DLM local network.
9. Adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.
10. A complete set of dimming features described above in the paragraph detailing On/Off/Dimming Enhanced Room Controllers.
    a. WattStopper product numbers: Fixture Controller: LMFC-011, DLM Cable Connector: LMFC-RJ-50-24 or LMFC-2RJ, Power Booster: LMPB-100.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
    1. Digital calibration and pushbutton configuration for the following variables:
        a. Sensitivity, 0-100 percent in 10 percent increments
        b. Time delay, 1-30 minutes in 1 minute increments
        c. Test mode, Five second time delay
        d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
        e. Walk-through mode
    2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
    3. Programmable control functionality including:
        a. Each sensor may be programmed to control specific loads within a local network.
        b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
        c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
        d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
        e. Ultrasonic and Passive Infrared
        f. Ultrasonic or Passive Infrared
        g. Ultrasonic only
        h. Passive Infrared only
        i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
    4. One or two RJ-45 port(s) for connection to DLM local network.
    5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
    6. Device Status LEDs, which may be disabled for selected applications, including:
        a. PIR detection
        b. Ultrasonic detection
        c. Configuration mode
        d. Load binding
    7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
    8. Manual override of controlled loads.
    9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:

1. Detection state
2. Occupancy sensor time delay
3. Occupancy sensor sensitivity, PIR and Ultrasonic

C. Units shall not have any dip switches or potentiometers for field settings

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.5 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton configuration for the following variables:
      a. Sensitivity: 0-100 percent in 10 percent increments
      b. Time delay: 1-30 minutes in 1 minute increments
      c. Test mode: Five second time delay
      d. Detection technology: PIR, Dual Technology activation and/or re-activation.
      e. Walk-through mode
      f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   2. Programmable control functionality including:
      a. Each sensor may be programmed to control specific loads within a local network.
      b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
      c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
      d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
         1) Ultrasonic and Passive Infrared
         2) Ultrasonic or Passive Infrared
         3) Ultrasonic only
         4) Passive Infrared only
   3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
   4. Two RJ-45 ports for connection to DLM local network.
   5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
   6. Device Status LEDs including
      a. PIR detection
      b. Ultrasonic detection
      c. Configuration mode
      d. Load binding
   7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
   8. Assignment of local buttons to specific loads within the room without wiring or special tools
   9. Manual override of controlled loads
   10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Detection state
   2. Occupancy sensor time delay
   3. Occupancy sensor sensitivity, PIR and Ultrasonic
   4. Button state
   5. Switch lock control
   6. Switch lock status

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
   1. Left button
      a. Press and release - Turn load on
      b. Press and hold - Raise dimming load
   2. Right button
      a. Press and release - Turn load off
      b. Press and hold - Lower dimming load

F. Low voltage momentary pushbuttons shall include the following features:
   1. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
   2. The following button attributes may be changed or selected using a wireless configuration tool:
      a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
      b. Individual button function may be configured to Toggle, On only or Off only.
      c. Individual scenes may be locked to prevent unauthorized change.
      d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
      e. Ramp rate may be adjusted for each dimmer switch.
      f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
      g. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.6 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4 button configurations as shown on plan documents. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall. **All faceplates shall be provided with samples for review prior to installation**. All faceplates must be installed and complete prior to punch list.
   3. Configuration LED on each switch that blinks to indicate data transmission.
   4. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
      d. Dimming paddle switches shall include seven bi-level LEDs to indicate load

levels using 14 steps.

5. Programmable control functionality including:
   a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
   b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Button state
   2. Switch lock control
   3. Switch lock status

C. Two RJ-45 ports for connection to DLM local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
   1. Individual button function may be configured to Toggle, On only or Off only.
   2. Individual scenes may be locked to prevent unauthorized change.
   3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   4. Ramp rate may be adjusted for each dimmer switch.
   5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
   6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.7 DIGITAL DAYLIGHTING SENSORS

A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
   1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
   2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
   3. Dual loop sensors measure both ambient and incoming daylight in the space to ensure that proper light levels are maintained as changes to reflective materials are made in a single zone

B. Digital daylighting sensors shall include the following features:
   1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
   2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
   3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).

4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
    a. Light level
    b. Day and night setpoints
    c. Off time delay
    d. On and off setpoints
    e. Up to three zone setpoints
    f. Operating mode - on/off, bi-level, tri-level or dimming
14. One RJ-45 port for connection to DLM local network.
15. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
16. Any load or group of loads in the room can be assigned to a daylighting zone
17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Closed loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
4. WattStopper Product Number: LMLS-400, LMLS-400-L.

D. Open loop digital photosensors shall include the following additional features:

1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
4. WattStopper Product Number: LMLS-500, LMLS-500-L.

E. Dual loop digital photosensors shall include the following additional features:
1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
6. Device must include extendable mounting arm to properly position sensor within a skylight well.
7. WattStopper product number LMLS-600

2.8 DLM SEGMENT NETWORK

A. Provide a segment network using linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.
1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
3. Segment network utilizes 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
4. Network wire jacket is available in high visibility green, white, or black.
5. Substitution of manufacturer-supplied cable is not permitted and may void the warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
6. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
7. Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER or LMSM Unit. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable

B. WattStopper Product Number: LM-MSTP, LM-MSTP-W, LM-MSTP-B, LM-MSTP-DB

2.9 NETWORK BRIDGE

A. Network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. Network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
   1. Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
   2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
   3. Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
      a. Read/write the normal or after hours schedule state for the room
      b. Read the detection state of each occupancy sensor
      c. Read the aggregate occupancy state of the room
      d. Read/write the On/Off state of loads
      e. Read/write the dimmed light level of loads
      f. Read the button states of switches
      g. Read total current in amps, and total power in watts through the load controller
      h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
      i. Activate a preset scene for the room
      j. Read/write daylight sensor fade time and day and night setpoints
      k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
      l. Set daylight sensor operating mode
      m. Read/write wall switch lock status
      n. Read watts per square foot for the entire controlled room
      o. Write maximum light level per load for demand response mode
      p. Read/write activation of demand response mode for the room
      q. Activate/restore demand response mode for the room

B. WattStopper product numbers: LMBC-300

2.10 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:
   1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
   2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
   3. Interior assembly shall be supplied as a factory assembled component specifically

designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:

a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
b. Individual terminal block, override pushbutton, and LED status light for each relay.
c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
   a. Electrical:
      1) 30 amp ballast at 277V
      2) 20 amp ballast at 347V
      3) 20amp tungsten at 120V
      4) 30 amp resistive at 347V
      5) 1.5 HP motor at 120V
      6) 14,000 amp short circuit current rating (SCCR) at 347V
      7) Relays shall be specifically UL 20 listed for control of plug-loads
   b. Mechanical:
      1) Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.
      2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
      3) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
      4) Tested to 300,000 mechanical on/off cycles.
5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the

requirements of UL924 and NFPA 70 - Article 700.

8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
   a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 tnetworked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
   b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
   c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
   d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
      1) Scheduled ON / OFF
      2) Manual ON / Scheduled OFF
      3) Astro ON / OFF (or Photo ON / OFF)
      4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
   e. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
   f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
   g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
    a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
    b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
    c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
    d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
    e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
    f. Setup and commissioning of panel shall not require manufacturer-specific

software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:

1) Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
2) Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
3) Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
4) Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.

g. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
h. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)
i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
    a. Use the same intelligence board as the LMCP relay panel.
    b. Shall not include relay driver boards or relays.
    c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
    d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
    e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.
12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.
13. WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.

B. User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
    1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.

2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. WattStopper Product Number: LMCT-100

2.11 SEGMENT MANAGER

A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).

B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external BACnet-to-IP interface routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the Drawings.

C. Operational features of the Segment Manager shall include the following:
1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. The Segment Manager shall not require installation of any lighting control software on an end-user PC.
3. Log in security capable of restricting some users to view-only or other limited operations.
4. Segment Manager shall provide two main sets of interface screens - those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system, and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:
    a. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
    b. Allow information for all discovered DLM devices to be imported into the Segment Manager via a single XML based site file from the WattStopper LMCS Software, significantly reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location

information and overall structure of DLM network. Info entered into LMCS should not have to be re-entered manually via keystrokes into the Segment Manager

c. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.

d. Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.

e. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance.

5. Capabilities using the Segment Manager's Dashboard Screens shall include:

a. A dynamic "tile" based interface that allows easy viewing of each individual room's lighting and plug load power consumption, and lighting and plug load power density (power consumption information requires Enhanced DLM Room and Plug Load Controllers with integral current transducers such as LMRC-21x).Tiles will be automatically organized according to location so a single tile for the building summarizes all information for tiles beneath it on every floor, in every area, in every room. Tiles use three color coded energy target parameters, allowing an owner to quickly identify rooms that are not performing efficiently. Tiles for rooms with occupancy sensors shall include an icon to indicate whether that room is occupied. Tiles shall be clickable, and when clicked the underlying hierarchical level of tiles shall become visible. Tile interface shall be accessible via mouse, or touch screen devices. Tiles shall be created automatically by the segment manager, based on the information found during the device discovery and/or information included in a file imported in from LMCS (such as tagged descriptions for each room) without any custom programming.

b. Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms with either on/off or normal hours/after hours set controlled zones or areas to either a normal hours or after hours mode of operation. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as astro On or astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week or month.

c. For fixtures that are accessible via the Segment Network, and have CCT capability as specified under paragraph Digital Wall Switch and Timer For Correlated Color Temperature, the Segment Manager will provide schedule functionality similar to the CCT Wall Timer, allowing all CCT fixtures across the entire facility to be scheduled together.

d. Ability to provide a simple time vs. power graph based on information stored in each Segment Manager's memory (typically two to three days' data).

6. Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

D. Segment Manager v2.2 and later shall support multiple DLM rooms as follows:

1. Support up to 120 network bridges and 750 digital in-room devices (LMSM-3E).
2. Support up to 200 network bridges and 1,100 digital in room devices, connected via network routers and switches (LMSM-6E).

E. WattStopper Product Numbers: LMSM-3E, LMSM-6E, LM-SUPERVISOR, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.12 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

B. Additional parameters exposed through this method include but are not limited to:
1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6. Load control polarity reversal so that on events turn loads off and vice versa.
7. Per-load DR (demand response) shed level in units of percent.
8. Load output pulse mode in increments of 1second.
9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
1. Device list report: All devices in a project listed by type.
2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.

D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
1. Set, copy/paste an entire project site of sensor time delays.

2. Set, copy/paste an entire project site of sensor sensitivity settings.
3. Search based on room name and text labels.
4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
5. Filter by parameter value to search for product with specific configurations.

E. Network-wide firmware upgrading remotely via the BACnet/IP network.
1. Mass firmware update of entire rooms.
2. Mass firmware update of specifically selected rooms or areas.
3. Mass firmware upgrade of specific products

F. WattStopper Product Number: LMCS-100, LMCI-100

2.13 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 EXECUTION

3.1 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.2 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.
3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
4. Low voltage wiring topology must comply with manufacturer's specifications.
5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

C. All line voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

L. Remote Access for Network Systems: If "REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS" is specified in Part 1 of this specification, ensure Segment Manager enclosure is installed in a location with good to excellent cellular phone coverage based on building orientation and geographic location, and mount magnetic antenna for the modem. For cases where alternate mounting locations are not available and a stronger cellular signal is needed, the manufacturer shall offer additional antenna options to improve signal quality. Verify final mounting location with Engineer and Owner prior to proceeding with the Work.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
   1. Verify Class I and II wiring connections are terminated properly by validating system performance.
   2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
   3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
   4. Verify that the control of each space complies with the Sequence of Operation.
   5. Correct any system issues and retest..

C. Provide a report in table format with drawings, or using a software file that can be opened in

the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:

1. Date of test or inspection.
2. Loads per space, or Fixture Address identification.
3. Quantity and Type of each device installed
4. Reports providing each device's settings.

3.4 DEMONSTRATION AND TRAINING

A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
   1. Confirmation of entire system operation and communication to each device.
   2. Confirmation of operation of individual relays, switches, and sensors.
   3. Confirmation of system Programming, photocell settings, override settings, etc.
   4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.5 GENERAL PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

3.6 SUPPORT SERVICES

Service Description:

A. System Startup
   1. Manufacturer shall have a factory authorized technician confirm proper installation and operation of all system components. The startup requirement is intended to verify:
      a. That all occupancy sensors are located, installed, and adjusted as intended by the factory and the contract documents.
      b. The occupancy sensors are operating within the manufacturers specifications.
      c. The sensors and relay panels interact as a complete and operational system to meet the design intent.
   2. Manufacturer to provide minimum of two day factory start-up at site. Additional days shall be included as required
   3. Manufacturer to provide a written statement verifying that the system meets the above requirements.

B. Training
   1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and controls.
   2. Manufacturer shall provide minimum of one day on site training.
   3. Training shall be video recorded and provided to Owner on a DVD.

C. Factory Commissioning
   1. Manufacturer shall provide factory authority technician for on site Commissioning Agent Testing. Number of days on-site shall be as necessary based on number of components and systems.
   2. Factory Commissioning shall include:

a. Fine tune occupancy sensors.
b. Program daylight harvesting.
c. Program relay panels,
d. Program dimming panels.
e. Fine tune dimming controls.

D. Follow-up Site Assistance

1. The lighting controls representative shall visit the site 11 months post final commissioning to ensure the system is operating appropriately and make any fine-tuning programming adjustments as requested by the owner at that time.

   The controls representative shall also provide an additional 1-day training session for the owner at the 11 month post final commissioning date.

END OF SECTION 26 09 23

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Two-winding transformers.

B. Related Requirements:
   1. Section 03 30 00 - Cast-In-Place Concrete: Housekeeping pads.
   2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   4. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
   5. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA ST 1 - Specialty Transformers (Except General Purpose Type).
   2. NEMA ST 20 - Dry Type Transformers for General Applications.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

C. Test and Evaluation Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

D. Source Quality Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Record Documentation: Record actual locations of transformers.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Product storage and handling requirements.

B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 TWO-WINDING TRANSFORMERS

A. Manufacturer List:
1. Eaton Electrical.
2. General Electrical.
3. Square D.
4. Seimens.

B. Substitution Limitations:
1. General Conditions: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers, ratings as indicated on Drawings.

D. Operation:
1. Primary Voltage: 480 volts, 3 phase.
2. Secondary Voltage: 208Y/120 volts, 3 phase.
3. Insulation system and average winding temperature rise for rated kVA as follows:
4. 1-15 kVA: Class 185 with 115 degrees C rise.
5. 16-500 kVA: Class 220 with 150 degrees C rise.
6. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.
7. Winding Taps:
   a. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
   b. Transformers 15 kVA and Larger: NEMA ST 20.
8. Sound Levels: NEMA ST 20.
9. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.
10. Mounting:
    a. 1-15 kVA: Suitable for wall mounting.
    b. 16-75 kVA: Suitable for wall, floor, or trapeze mounting.
    c. Larger than 75 kVA: Suitable for floor or trapeze mounting.

E. Materials:
1. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.
2. Coil Conductors: Continuous copper windings with terminations brazed or welded.
3. Enclosure: NEMA ST 20, Type 1 or Type 3R ventilated as required to meet service conditions. Furnish lifting eyes or brackets.

F. Fabrication:
   1. Isolate core and coil from enclosure using vibration-absorbing mounts.
   2. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.2 SOURCE QUALITY CONTROL

A. General Conditions: Testing, inspection and analysis requirements.

B. Production test each unit according to NEMA ST20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Requirements for installation examination.

B. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.2 PREPARATION

A. General Conditions: Requirements for installation preparation.

B. Provide concrete pads under provisions of Section 03 30 00.

3.3 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, in accordance with Section 26 05 33, 2 feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Support transformers in accordance with Section 26 05 29.
   1. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.
   2. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure.
   3. Mount trapeze-mounted transformers as indicated on Drawings.

D. Provide seismic restraints.

E. Install grounding and bonding in accordance with Section 26 05 26.

3.4 FIELD QUALITY CONTROL

A. General Conditions: Requirements for inspecting and testing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.2.1.

3.5 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

3.6 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean existing transformers to remain or to be reinstalled.

END OF SECTION 26 22 00

SECTION 26 24 13 – SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes main and distribution switchboards.

B. Related Sections
1. Section 03 30 00 – Cast-In-Place Concrete for concrete pads.
2. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
3. Section 26 05 53 – Identification for Electrical Systems.
4. Section 26 25 00 – Enclosed Bus Assemblies.
5. Section 26 28 13 – Fuses.
6. Section 26 35 56 – Surge Protective Devices.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI C12.1 - Code for Electricity Metering.
2. ANSI C39.1 - Requirements, Electrical Analog Indicating Instruments.

B. Institute of Electrical and Electronics Engineers:
1. IEEE C57.13 - Standard Requirements for Instrument Transformers.
2. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

C. National Electrical Manufacturers Association:
1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
3. NEMA PB 2 - Deadfront Distribution Switchboards.
4. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.

D. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

E. Underwriters Laboratories Inc.:
1. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
2. UL 891 - Dead-Front Switchboards.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars for each phase, neutral, and ground; and switchboard instrument details.

C. Product Data: Submit electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.

D. Test Reports: Indicate results of factory production and field tests.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations, configurations, and ratings of switchboards and their components on single line diagrams and plan layouts.

C. Operation and Maintenance Data: Submit spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Requirements for transporting, handling, storing, and protecting products.

B. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

C. Accept switchboards on site. Inspect for damage.

D. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

A. General Conditions.

B. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 SEQUENCING

A. General Conditions: Work sequence.

B. Sequence Work to avoid interferences with building finishes and installation of other products.

1.10 MAINTENANCE MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish two of each key.

1.11 EXTRA MATERIALS

A. General Conditions: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 DISTRIBUTION SWITCHBOARDS

A. Manufacturers:
1. Eaton Electrical.
2. GE Electric Company.
3. Siemens Energy & Automation, Inc.
4. Square D Company.
5. Substitutions: General Conditions.

B. Product Description: NEMA PB 2, enclosed switchboard with electrical ratings and configurations as indicated on Drawings.

C. Service Conditions:
1. Temperature: 100 degrees F.
2. Altitude: 4500 feet.

D. Device Mounting:
1. Main Section: Individually mounted and compartmented.
2. Distribution Section: Individually mounted and compartmented.
3. Auxiliary Section: Individually mounted.

E. Bus:
1. Material: Copper, standard size.
2. Connections: Bolted, accessible from front for maintenance.
3. Insulation: Fully insulate bus bars. Do not reduce spacing of insulated bus.
4. The phase and neutral through-bus shall have an ampacity as shown on the plans. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus in not acceptable. Provide full height vertical bus in all sections with minimum number of spaces as shown on Single Line Diagram. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.

F. Ground Bus: extend length of switchboard.

G. Minimum Short Circuit Rating: 65,000 symmetrical amperes rms, fully rated, or as indicated.

H. Line and Load Terminations: Accessible from front only of switchboard, suitable for conductor materials and sizes as indicated on Drawings.

I. Utility Metering Compartment: Furnish metering transformer compartment for Utility Company's use, in accordance with Utility Company requirements.

J. Pull Section: Width, depth and height to match switchboard. Arrange as indicated on Drawings.

K. Pull Box: Removable top and sides, same construction as switchboard, Furnish insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.

L. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents. Furnish continuous current rating as indicated on Drawings. Switchboard provisional spaces shall be labeled with max ampacity and frame type of circuit breaker.

M. Enclosure: Type 1 - General Purpose. All Front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins. Floor mounted on concrete pad.

N. Align sections at front and rear.

O. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

2.2 FUSIBLE SWITCH ASSEMBLIES

A. Product Description: NEMA KS 1, Type HD, load interrupter knife switch. Handle lockable in OFF position.

B. Fuse clips: Designed to accommodate NEMA FU 1, Class J fuses.

2.3 MOLDED CASE CIRCUIT BREAKER

A. Product Description: UL 489, molded-case circuit breaker.

B. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 250 amperes and larger have mechanism for adjusting continuous current setting for automatic operation.

C. Current Limiting Circuit Breaker: Circuit breaker indicated as current-limiting have automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.

D. Solid-State Circuit Breaker (for all breakers 800 amp and larger): Electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip with zero sequence type ground fault sensor (where indicated); instantaneous trip; adjustable short time trip; and energy-reducing active arc flash mitigation system (1200 amp and larger only).

E. Current Limiter: Designed for application with molded case circuit breaker.
   1. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.
   2. Interlocks trip circuit breaker and prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.

F. Accessories: Conform to UL 489.
   1. Shunt Trip Device: As shown on plans.
   2. Undervoltage Trip Device: All main breakers.
   3. Auxiliary Switch: As shown on plans.
   4. Alarm Switch: As shown on plans.
   5. Handle Lock: Provisions for padlocking.
   6. Insulated Grounding Lug: In each enclosure.

2.4 GROUND FAULT DEVICES

A. Ground Fault Sensor: Zero sequence type.

B. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Furnish monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

2.5 SURGE PROTECTIVE DEVICES

A. Product Description: IEEE C62.41, factory-mounted transient voltage surge suppressor, selected to meet requirements for medium exposure and to coordinate with system circuit voltage. See specification section 26 35 56.

2.6 ACCESSORIES

A. Concrete: 3,000 psi (20 MPa) as specified in Section 3.

2.7 SOURCE QUALITY CONTROL

A. Furnish shop inspection and testing in accordance with NEMA PB 2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify surface is suitable for switchboard installation.

3.2 PREPARATION

A. Concrete Pad: Comply with requirements of Section 03 30 00.

3.3 INSTALLATION

A. Install in accordance with NEMA PB 2.1.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

C. Install fuses in each switch and coordinate sizes with connected load.

D. Install engraved plastic nameplates in accordance with Section 26 05 53.

E. Install breaker circuit directory.

F. Ground and bond switchboards in accordance with Section 26 05 26.

3.4 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.1.

D. Measure, using a Megger, the insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 VDC; minimum acceptable value for insulation resistance is 1 megohms. Note: Refer to manufacturer's literature for specific testing procedures.

3.5 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Adjust operating mechanisms for free mechanical movement.

C. Tighten bolted bus connections.

D. Adjust circuit breaker trip and time delay settings to values as instructed by Architect/Engineer.

3.6 CLEANING

A. General Conditions: Final cleaning.

B. Touch up scratched or marred surfaces to match original finish.

END OF SECTION 26 24 13

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Distribution and branch circuit panelboards.

B. Related Requirements:
   1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   2. Section 26 05 53 - Identification for Electrical Systems.
   3. Section 26 28 13 - Fuses.

1.2 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers:
   1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
   3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
   4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
   5. NEMA PB 1 - Panelboards.
   6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories Inc.:
   1. UL 50 - Cabinets and Boxes
   2. UL 67 - Safety for Panelboards.
   3. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
   4. UL 1283 - Electromagnetic Interference Filters.
   5. UL 1449 - Transient Voltage Surge Suppressors.
   6. UL 1699 - Arc-Fault Circuit Interrupters.

1.3 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Product Data: Submit catalog data showing specified features of standard products.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

D. Source Quality control submittals: Indicate results of factory tests and inspections.

E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. General Conditions: Requirements for maintenance products.

B. Extra Stock Materials:
1. Furnish two of each panelboard key. Panelboards keyed alike.

1.6 QUALITY ASSURANCE

A. Qualifications
1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

A. Manufacturer List:

Manufacturer	Lighting Panels rated 240V	Lighting Panels rated 480/277V	Distribution Panels rated 600V
Square D	NQOD	NF	I-Line
ABB/GE	AQ	AE	Spectra
Eaton Cutler-Hammer	Pow-R-Line 1A	Pow-R-Line 2A	Pow-R-Line 4B
Siemens	S1	S2	S5

B. Substitution Limitations:
1. General Conditions: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA PB 1, circuit breaker type panelboard. Distribution boards shall be floor mounted.

D. Operation:
   1. Service Conditions:
      a. Temperature: 100 degrees F.
      b. Altitude: 4500 feet.
   2. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.

E. Materials
   1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
   2. Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
   3. Molded Case Circuit Breakers with Current Limiters: UL 489, circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
   4. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
   5. Surge Suppressers: Integrated in panelboard, refer to Section 26 35 53.
   6. Enclosure: NEMA PB 1, Type 1or as required to meet service conditions.
   7. Cabinet Front: Surface door-in-door type, fastened with concealed trim clamps, hinged door with flush lock and plastic directory card holder. Fronts shall have cylindrical tumbler type lock with catch and spring-loaded door pull. All lock assemblies shall be keyed alike.
   8. Circuit breaker accessories: Trip units and auxiliary switches as indicated on drawings.

F. Finishes
   1. Manufacturer's standard gray enamel.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Manufacturer List:

Manufacturer	Lighting Panels rated 240V	Lighting Panels rated 480/277V	Distribution Panels rated 600V
Square D	NQOD	NF	I-Line
ABB/GE	AQ	AE	Spectra
Eaton Cutler-Hammer	Pow-R-Line 1A	Pow-R-Line 2A	Pow-R-Line 4B
Siemens	S1	S2	S5

B. Substitution Limitations:
   1. General Conditions: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

D. Materials:
   1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
   2. For non-linear load applications subject to harmonics furnish 200 percent rated, plated copper, solid neutral.

3. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.
4. Molded Case Circuit Breakers: UL 489, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Provide UL class 760 arc-fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
5. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
6. Enclosure: NEMA PB 1, Type 1 or Type 3R as required to meet service conditions.
7. Split solid neutral shall be plated and located in the main compartment up to 225 amperes so incoming neutral cable may be of the same length. UL listed paneboards with 200% rated solid neutral shall be plated copper for non-linear load applications. Panelboards shall be marked for non-linear load applications.
8. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.
9. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL listed for reverse connection without restrictive line or load markings. Circuit breaker handle accessories shall provide provisions for locking handle in the OFF position.

E. Cabinet Front: Door-in-door Flush or Surface cabinet front as indicated on drawings with concealed trim clamps, concealed hinge, plastic directory card holder, and flush lock keyed alike. Front shall have cylindrical tumbler type lock with catch and spring-loaded door pull. All lock assemblies shall be keyed alike. Finishes:
   1. Finish in manufacturer's standard gray enamel.

2.3 SOURCE QUALITY CONTROL

A. General Conditions: Testing, inspection and analysis requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb.

C. Install recessed panelboards flush with wall finishes.

D. Height: 6 feet (1800 mm) to top of panelboard install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.

E. Install filler plates for unused spaces in panelboards.

F. Provide typed circuit directory for each branch circuit panelboard and load center. Revise directory to reflect circuiting changes to balance phase loads. Identify each circuit as to its clear, evident and specific purpose of use.

G. Install engraved plastic nameplates in accordance with Section 26 05 53.

H. Install spare conduits out of each recessed panelboard to accessible location above ceiling and below slab not on grade. Minimum spare conduits: 5 empty 1 inch (DN27) (above and below). Identify each as SPARE.

I. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

J. Provide each panelboard with nameplate showing panel designation, voltage rating and phase. Indicate source of power (feeder origin) and feeder size (awg/mils and conduit).

K. Label shall be engraved laminated-plastic nameplate. Nameplates shall be black with white letters (normal power) or red with white letters (emergency power).

L. Mount panelboards securely to building structure with 3/8" minimum diameter galvanized bolts and inserts number as required for size of panel, but not less than 4. Mount panelboards with centerline 4'-6" approximately above finished floor with the top a maximum of 74” AFF. Where panels of different heights are mounted adjacent, install top of panel trim at same height above floor. Close all unused openings.

M. Mount feeder panelboards taller than 66" on 4" high 2500# concrete pad and bolt to wall and pad with 1/2" diameter bolts and inserts .Breaker handles in the “ON” position shall not be higher than 6-7” to centerline from the Finished Floor when panelboards are installed on concrete pads

N. Where two sets of feeder cables are required in panel gutter space, run one set in each side of panel.

O. When connecting a panelboard to a transformer, connected conductors shall include a slack 90-degrees bend in flexible conduit between the transformer and any subsequent rigid connection to building structure. Use stranded, flexible conductors to maintain as much flexibility as practical. Do not permit flexible conductors to contact or drape against floor or wall surfaces. The first panelboard, cabinet or switch connected to a transformer shall be resiliently supported from structure by affixing with bolts through holes with grommets (wall supported; equal to Kinetics Model TG Isolation Grommet) or by being set on ¾” thick Neoprene isolation pads (equal to Kinetics Type RSP) sized so that the supported load deflects pads approximately 0.12”, or in the upper half of the manufacturer’s recommended loading range in pounds per square inch. Pad type isolators should use load spreading steel plates to avoid damaging the pad by narrow base rails or sections, as required.

P. Provide seismic bracing in accordance with the manufacturer's recommendations and in compliance with the seismic zone requirements for the zone in which the equipment is located.

Q. Connect only one wire/cable to each breaker terminal.

3.2 FIELD QUALITY CONTROL

A. General Conditions: Requirements for testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.

E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.3 ADJUSTING

A. General Conditions: Requirements for starting and adjusting.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.4 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean interior of panelboards of all debris at substantial completion.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; wall and ceiling occupancy sensors; receptacles; multioutlet assembly; and device plates and decorative box covers.

B. Related Sections:
1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.
2. Section 26 09 23 – Lighting Control Devices; Wall and ceiling occupancy sensors.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 EXTRA MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish two of each style, size, or switch, receptacle type and finish wall plate.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:
1. Cooper Wiring Devices.
2. Hubbell, Inc.
3. Leviton Manufacturing Company.
4. P&S.
5. Substitutions: Upon review.

B. Product Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.

C. Body and Handle: White plastic with toggle handle.

D. Indicator Light: Lighted handle type switch; green color handle.

E. Locator Light: Lighted handle type switch; red color handle.

F. Ratings:
1. 120-277 volts, AC.
2. Current: 20 amperes.

2.2 WALL DIMMERS

A. Manufacturers:
1. Eagle.
2. Hubbell Wiring Devices.
3. Leviton.
4. Lutron.
5. P&S.
6. Synergy Lighting Controls.
7. Substitutions: Not Permitted.

B. Product Description: NEMA WD 1; Semiconductor dimmer for the following load types.
1. Dimmers shall provide full range, continuously variable control of light intensity.
2. Controls shall provide preset single pole, 3-way, or multi-location control from the dimmer location regardless of the position of the other 3-way switch location.
3. Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.
4. Operate at the rated capacity across the full ambient temperature range including modified capacities for ganging configurations with require the removal of fins.
5. Control should be designed to not interfere with audio, video, or radio equipment.
6. Utilize air gap off, activated when user selects “off” at any control to disconnect the load from line supply eliminating any leakage current.
7. Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption.
8. Designed and tested with withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.
9. Design and test dimmers to withstand line-side surges without impairment to performance when subjected to surges of 6,000 volts, 200 amps per ANSI/ IEEE C62.41C.
10. Capable of operating at the rated capacity; this includes modified capacities for ganging configurations which require the removal of fins. Operation at rated capacity shall be possible across the full ambient temperature range, without shortening design lifetime.

C. Load Specific Requirements: Within rated capacity, dimmers shall be available for direct control of the following loads.
1. Dimming LED Lamps:
a. Contain circuitry specifically designed to control dimmable self ballasted CFL loads.
b. Provide with lower dimming range adjustment.
c. Listed to UL 172.
2. Electronic Low Voltage (ELV):
a. Dimmers shall contain circuitry specifically designed to control the input of electronic solid state low voltage transformers.

b. Shall have a maximum output of no less than 92% of line voltage.
c. Dimmers using standard phase control shall not be acceptable.

3. Fan Speed Control:
   a. Fully Variable fan speed controls for paddle fans, ventilation fans and exhaust fans.
   b. Quiet fan speed controls shall provide low-medium-high speeds settings and off.
   c. Shall be listed to UL 1917.
4. Remote Dimming Modules:
   a. Provide high power module and wall dimmer from a single manufacturer.
   b. High power module listed to UL 508 for control of incandescent/ halogen, magnetic low voltage, electronic low voltage, fluorescent, and neon/cold cathode loads. Provide high power modules as defined on project drawings.

D. Body and Handle: White Nylon or match existing with linear slide.

E. Voltage: 120 or 277 volts.

F. Power Rating: Match load shown on drawings; 600 watts minimum.

G. Accessory Wall Switch: Match dimmer appearance.

2.3 OCCUPANCY SENSORS AND POWER PACKS

A. Occupancy Sensors

1. Ceiling sensors.
2. Wall sensors.
3. Dual technology sensors shall:
   a. Either corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas
   b. Passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
4. Ultrasonic sensors shall:
   a. Utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.
   b. Have an ultrasonic operating frequency that is crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
5. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
6. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
7. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
8. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
9. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

B. Products
   1. Wall Mounted Single Level Motion Sensor Switch.
   2. Wall Mounted Bi-Level Motion Sensor Switch.
   3. Ceiling Mounted Dual Technology Occupancy Sensor with Power Pack.

C. Circuit Control Hardware – (Power Packs)
   1. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
   2. Provide power packs as required. Power Pack shall be installed in jbox.
   3. Relay Contacts shall have ratings of:
      a. 13A - 120 VAC Tungsten
      b. 20A - 120 VAC Ballast
      c. 20A - 277 VAC Ballast
      d. 20A – 347 VAC Ballast

D. Control wiring between sensors and control units shall be Class II, 18-20 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
   1. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

E. Mount switches and occupancy sensors as indicated on Drawings and by manufacturer's requirements.

CONTROL TYPE	**COMMISSIONING AND CALIBRATION**
Occupancy sensors	Ensure that the sensor is correctly placed and oriented per the specifications and/ or construction drawings. If unanticipated obstructions are present, it may be necessary to adjust the sensor location and orientation.
Occupancy sensors	Adjust the sensitivity and time delay of the occupancy sensor, and test to ensure it provides appropriate response. For optimal user acceptance, energy savings and lamp life, set the time delay initially for a minimum of 15 minutes (NEMA recommendation).
Manual dimming	Ensure correct placement of the dimmer per the construction drawings. Adjust the upper limit of the dimming range according to the task being performed, and set the lower limit of the range so that the minimum light level meets the use/application of the space.

2.3 RECEPTACLES

A. Manufacturers:
   1. Cooper Wiring Devices.
   2. Harvey Hubbell, Inc.
   3. Leviton Manufacturing Company.

4. P&S.
5. Substitutions: Not permitted.

B. Product Description: NEMA WD 1, Heavy-duty general use receptacle.
1. Receptacles shall be Tamper-Resistant where required by section 406.12 of the National Electrical Code, 2017.

C. Device Body: White nylon.

D. Configuration: NEMA WD 6, type as indicated on Drawings.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.4 WALL PLATES

A. Manufacturers:
1. Cooper Wiring Devices.
2. Harvey Hubbell, Inc.
3. Leviton Manufacturing Company.
4. P&S.
5. Substitutions: Not permitted.

B. Decorative Cover Plate: White nylon.

C. Jumbo Cover Plate: White nylon.

D. Weatherproof Cover Plate: Gasketed cast metal plate with hinged and gasketed cast metal cover device cover. The system shall be weatherproof while in use.

E. Wall plates for devices in laboratories, kitchen areas, mechanical rooms, where located on CMU/block Surface and other similar areas shall be beveled edge stainless steel plates, single or multi-gang as required by the outlet. Wall plates for devices in surface boxes, unless specified otherwise, shall be beveled edge satin finish stainless steel plates, single or multi-gang as required by the outlet. Blank plates shall be furnished and installed on all empty, blanked or unused outlets. Device plates manufactured by device manufacturer where available. Wall Plates shall be single and combination types that mate and match with corresponding devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on bottom.

F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

G. Install wall plates on flush mounted switches, receptacles, and blank outlets.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping solid conductor around screw terminal. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

J. Use jumbo size plates for outlets installed in masonry walls.

K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

L. Match devices to plug connectors for Owner-furnished equipment. Verify type, configuration, etc., prior to providing devices. Including all such costs in bid submission.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as indicated on drawings.

B. Install wall switch 48 inches above finished floor.

C. Install convenience receptacle 18 inches above finished floor.

D. Install convenience receptacle 6 inches above back splash of counter.

E. Install dimmer 48 inches above finished floor.

3.5 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. General Conditions: Final cleaning.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fuses and spare fuse cabinet.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 DESIGN REQUIREMENTS

A. Select fuses to provide appropriate levels of short circuit and overcurrent protection for the following components: wire, cable, bus structures, and other equipment. Design system to maintain component damage within acceptable levels during faults.

B. Select fuses to coordinate with time current characteristics of other overcurrent protective elements, including other fuses, circuit breakers, and protective relays. Design system to maintain operation of device closest to fault operates.

1.4 FUSE PERFORMANCE REQUIREMENTS

A. Main Service Switches Larger than 600 amperes: Class L (time delay).

B. Main Service Switches: Class RK1 (time delay).

C. Power Load Feeder Switches Larger than 600 amperes: Class L (time delay).

D. Power Load Feeder Switches: Class RK1 (time delay).

E. Motor Load Feeder Switches: Class RK1 (time delay).

F. Lighting Load Feeder Switches Larger than 600 amperes: Class L time delay.

G. Lighting Load Feeder Switches: Class RK1 (time delay).

H. Other Feeder Switches Larger than 600 amperes: Class L time delay.

I. Other Feeder Switches: Class RK1 (time delay).

J. General Purpose Branch Circuits: Class RK1 (time delay).

K. Motor Branch Circuits: Class RK1 (time delay).

L. Lighting Branch Circuits: Class G.

1.5 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents: Record actual sizes, ratings, and locations of fuses.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 MAINTENANCE MATERIALS

A. General Conditions: Spare parts and maintenance products.

1.9 EXTRA MATERIALS

A. General Conditions: Requirements for extra materials.

B. Furnish 20% spare fuses of each Class, size, and rating installed.

PART 2 - PRODUCTS

2.1 FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut
3. Substitutions: General Conditions

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.2 CLASS RK1 (TIME DELAY) FUSES

A. Manufacturers:
1. Bussman.
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.3 CLASS RK1 (NON-TIME-DELAY) FUSES

A. Manufacturers:
1. Bussman.
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.4 CLASS RK5 FUSES

A. Manufacturers:
1. Bussman.
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.5 CLASS J (TIME DELAY) FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.6 CLASS J (NON-TIME-DELAY) FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut.
3. Substitutions: General Conditions

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.7 CLASS L (FAST-ACTING) FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.8 CLASS L (TIME DELAY) FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut.
3. Substitutions: General Conditions

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.9 SPARE FUSE CABINET

A. Product Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.

B. Doors:Hinged, with hasp for Owner's padlock.

C. Finish: Gray enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuse with label oriented so manufacturer, type, and size are easily read.

B. Install spare fuse cabinet at location as directed by Owner.

END OF SECTION 26 28 13

SECTION 26 28 19 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fusible.
   2. Nonfusible switches.

B. Related Requirements
   1. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   2. Section 26 05 53 - Identification for Electrical Systems.
   3. Section 26 28 13 - Fuses.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Description: NEMA KS 1, Type HD (Heavy Duty), enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Operation:

1. Switch Ratings
    a. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
    b. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere). 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

C. Materials:
1. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
2. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
    a. Interior Dry Locations: Type 1.
    b. Exterior Locations: Type 3R.
3. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
4. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Description: NEMA KS 1, Type HD (Heavy Duty) enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Operation:
1. Switch Ratings
    a. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
    b. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere).

C. Materials:
1. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
    a. Interior Dry Locations: Type 1.
    b. Exterior Locations: Type3R.
2. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
3. Furnish switches with entirely copper current carrying parts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches where indicated. Secure switches to building or equipment surface as shown. Where the surface is not adaptable for mounting, provide unistrut P-1000 rack mounted as required to secure switch.

B. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

C. Height: 5 feet (1500 mm) to operating handle.

D. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

E. Install engraved plastic nameplates in accordance with Section 26 05 53. Engrave nameplates with the equipment served and the panel and circuit number supplying the switch.

F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

G. Secure switches and circuit breakers to building structure in accordance with seismic zone specified in other sections of this specification.

H. All exterior mounted switches shall comply with NEC 312.2.

I. All switches shall be mounted to comply with NEC 404.8.

3.2 FIELD QUALITY CONTROL

A. General Conditions: Requirements for testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

3.3 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean existing enclosed switches to remain or to be reinstalled.

END OF SECTION 26 28 19

SECTION 26 35 56 – SURGE PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes SPD for low-voltage power, control, and communication equipment.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.

B. Provide UL 1449, 3rd Edition test reports showing Suppressed Voltage Ratings (SVR) and all “Engineering Considerations”. The SPD shall also be complementary listed to UL 1283

C. Qualification Data: Provide the following:
   1. Provide test reports from a recognized independent testing laboratory verifying the COMPLETE SPD will survive the published and specified maximum surge current rating. Test reports will clearly show that all components that make up a COMPLETE system were included in these tests (including but not limited to all necessary fuses, thermal disconnects, integral disconnects and monitoring systems).
   2. Provide data confirming that the SPD will survive the published and specified repetitive surge current rating (longevity characteristic).
   3. Per the requirements of NEC Article 285.6, provide test data demonstrating that the SPD is capable of surviving the published and specified short circuit current capability (AIC rating) without the use of external fusing.
   4. Provide a COMPLETE set of test and ratings data per the recommendations of NEMA LS1 – 1992.

D. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.

E. Warranties: Special warranties specified in the Section.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency’s Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C62.41, “IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits,” and test devices according to IEEE C62.45, “IEEE Guide on Surge Testing for Equipment Connected to Lo-Voltage AC Power Circuits.”

E. Comply with NEMA LS1, “Low Voltage Surge Protection Devices.”

F. Comply with UL 1283, “Electromagnetic Interference Filters,” and UL 1449, “Transient Voltage Surge Suppressors.”

G. MIL-STD-220A Compliance: Comply with military standard for measuring filter attenuation using the 50-ohm insertion loss method.

1.5 PROJECT CONDITIONS

A. Placing into Service: Do not energize or connect service entrance equipment or panelboard to their sources until the surge protective devices are installed and connected.

B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
1. Maximum Continuous Operating Voltage: Not less than 115% of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C)
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.6 COORDINATION

A. Coordinate location of field-mounted surge suppressor to allow adequate clearances for maintenance.

1.7 WARRANTY

A. Most manufacturers offer five-year extended warranties on their equipment. Some manufacturers of cord-connected, plug-in surge suppressors offer extended warranties that either repair or replace damaged equipment that is protected by the suppressor. When warranties are required, verify with Owner’s counsel that special warranties stated in this Article are not less than remedies available to Owner under prevailing local laws. Coordinate with Division 1 Section “Warranties”.

B. General Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.

C. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer’s standard form in which manufacturer aggress to repair or replace electronic equipment connected to circuits protected by surge suppressors.

PART 2 – PRODUCTS

2.1 SERVICE ENTRANCE/DISTRIBUTION BOARD SUPPRESSORS

A. Surge Protection Device Description: Non-modular type from the following list of approved manufacturers and products provided the product meets all requirements of these Specifications:
1. Liebert Corporation – LM Series
2. Current Technology, Inc. – CG Plus Series
3. Eaton Cutler-Hammer - CPS Series

The SPD will be provided with the following features and accessories:
1. Repetitive Rating: SPD shall be capable of surviving at least 10,000 ANSI/IEEE C62.41 Category C3 impulses (10kA) without failure or less than 10% degradation of original performance characteristics.
1. Fusing system to provide 200kAIC short circuit rating.
2. Individually fused MOVs to provide system redundancy
3. Integral disconnect (only when a breaker is NOT provided in distribution equipment)
4. LED indicator lights for power and protection status.
5. Audible alarm, with silencing switch, to indicate when protection has failed.
6. One set of dry contacts rated at 5A and 250V ac, for remote monitoring of protection status.
7. NEMA 12 Enclosure

B. Surge Protection Device Description: Modular type from the following list of approved manufacturers and products provided the product meets all requirements of these Specifications:
1. Liebert Corporation – Interceptor II Series
2. Current Technology, Inc. – SEL Series
3. Eaton Cutler-Hammer – CPS Series

The modular SPD will be provided with the following features and accessories:
1. Repetitive Rating: SPD shall be capable of surviving at least 15,000 ANSI/IEEE C62.41 Category C3 impulses (10kA) without failure or less than 10% degradation of original performance characteristics.
2. Fusing system to provide 200kAIC short circuit rating.
3. Fabrication using bolted compression lugs for internal wiring.
4. Integral disconnect switch (only when a breaker is NOT provided in distribution equipment).
5. Individually fused MOVs to provide system redundancy.
6. Built-in push-to-test feature that tests the integrity of each fuse/MOV pair. Manufacturers who accomplish by use of an external surge generator will provide the device with their quotation.
7. Redundant replaceable modules
8. Arrangement with copper bus bars and for bolted connection to phase buses, neutral bus, and ground bus.
9. Arrangement with wire connection to phase buses, neutral bus, and ground bus.
10. LED indicator lights for power and protection status.
11. Audible alarm, with silencing switch, to indicate when protection has failed.
12. One set of dry contacts rated at 5A and 250V ac, for remote monitoring of protection status.
13. Surge event operations counter.
14. NEMA 4 Enclosure

C. Peak Single-Impulse Surge Current Rating: 250 kA per phase, 125kA per mode. Manufacturer will provide a higher maximum surge current rating if necessary to meet the repetitive requirements listed above.

D. Connection Means: Permanently wired.

E. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 480Y/277, 208Y/120, 3-phase, 4-wire circuits shall be as follows:
   1. Line to Neutral: 700V for 480Y/277, 400V for 208Y/120.
   2. Line to Ground: 700V for 480Y/277, 400V for 208Y/120.
   3. Neutral to Ground: 700V for 480Y/277, 400V for 208Y/120.

2.3 ENCLOSURES

A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 – EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Locate the externally mounted SPD as close as possible to the panelboard neutral lug. Locate the recommended breaker as close as possible to the SPD location. The panelboard manufacturer will supply the breaker. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
   1. Provide a multi-pole circuit breaker in the service entrance equipment and a multi-pole circuit breaker in branch panel equipment to serve as a dedicated disconnect for suppressor, unless otherwise indicated. Sized per manufacturer specifications.

3.2 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Testing: Perform the following field quality control testing:
   1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
   2. Complete startup checks according to manufacturer's written instructions.
   3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.19. Certify compliance with test parameters.

D. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

E. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
   1. Verify that electrical wiring installation complies with manufacturer's installation requirements.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain surge protective devices.
   1. Train Owner's maintenance personnel on procedures and schedules for maintaining suppressors.
   2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
   3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
   4. Schedule training with Owner, through Architect, with at least seven days' advanced notice.

END OF SECTION 26 35 56

SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior luminaires, lamps, ballasts, and accessories.

B. **LIGHTING AGENCIES, DISTRIBUTORS, ETC. ARE REQUIRED TO HAVE A COMPLETE FIXTURE SCHEDULE, ALL LIGHTING PLANS, ARCHITECTURAL REFLECTED CEILING PLANS AND SPECIFICATIONS IN ORDER TO BID THE PROJECT. PRICING SHALL NOT BE BASED ON CATALOG NUMBERS ALONE. COORDINATE AND PROVIDE ALL MOUNTING HARDWARE AND ACCESSORIES AS REQUIRED BY ARCHITECTURAL CEILING TYPES AND CEILING TILE CONFIGURATIONS. CHANGE ORDERS WILL NOT BE ALLOWED FOR FAILURE TO USE THE COMPLETE SET OF PLANS FOR BID PURPOSES.**

C. Related Sections:
   1. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables
   2. Section 26 05 23 – Lighting Control Devices
   3. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI_NEMA_ANSLG C78.377-2008 Specifications for the Chromaticity of Solid State Lighting Products.

B. Illuminating Engineering Society (IES)
   1. IES LM-79-08
   2. IES LM-80-08

C. US Department of Energy
   1. Lighting Facts

1.3 SYSTEM DESCRIPTION

A. Catalog numbers indicated in the Luminaire Schedule are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of light bar, driver, finish trim, ceiling type, mounting hardware or special requirements as specified or as required by the particular installations. Provide complete luminaire to correspond with the features, accessories, number of LED's, wattage and/or size specified in the text description of each luminaire type. Additional features, accessories and options specified shall be included.

Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed luminaires shall have frames that are compatible with the ceiling systems.

B. Luminaire voltage shall match the voltage of the circuit serving same.

1.4 SUBMITTALS

A. SUBSTITUTIONS

1. See General Conditions of the specifications for information regarding substitutions. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples if requested by Engineer are provided. Alternate products shall meet or exceed design criteria.

2. If submitted fixtures are not as specified, provide footcandle calculations showing the actual rooms, correct ceiling heights, mounting heights, and surface reflections. Provide IES files in digital format of all substituted fixtures to the Engineer for review. The engineers model will not be provided for this purpose. The lighting representative shall produce all required files and documentation to the satisfaction of the Engineer.

B. PRODUCT DATA

For each type of luminaire, arranged in order of luminaire designation. Include data on features, accessories, finishes, and the following:

1. Material and physical description of luminaire including dimensions.
2. Emergency lighting units including battery and charger.
3. Energy-efficiency data.
4. Life, output (lumens, CCT, and CRI), Kelvin temperature, and energy-efficiency data for LED light bars.
5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each luminaire type. The adjustment factors shall be for light bars, drivers, and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer. LM-79 and LM-80 data for solid state lighting.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Photometric data, certified by a qualified independent testing agency, in IESNA format, based on certified results of laboratory tests of each luminaire type, outfitted with light bars, drivers and accessories identical to those indicated for the luminaire as applied in the Project.
7. Low voltage transformers.
8. LED power supplies.
9. Types of LED's, including manufacturer, wattage, and Color Rendering Index (CRI) and color temperature in degrees Kelvin (K).

C. SHOP DRAWINGS

1. Show detail of nonstandard or custom luminaires.
2. Indicate dimensions, weights, method of field assembly, components, features and accessories.
3. For custom luminaires, modified luminaires or linear luminaires mounted in continuous rows, submit scaled drawings prepared by the manufacturer showing all details of construction, lengths in runs, pendant or power feed locations, accessories, finishes and lists of materials.
4. This Contractor shall provide the manufacturer with accurate field dimensions where required.
5. Include wiring diagrams, power and control wiring.

D. Wiring diagrams shall detail wiring for luminaires and differentiate between manufacturer installed and field installed wiring.

E. Dimming Driver Compatibility Certificates shall be signed by the manufacturer of driver certifying that drivers are compatible with dimming systems and equipment with which they are used.

F. Maintenance Data shall be provided for luminaires and equipment to include in emergency, operation and maintenance manuals specified in specifications section describing Operations and Maintenance Data.

G. Field quality control test reports.

H. Special Warranties specified in the Section.

I. Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall not be considered to be approval of said voltage, mounting condition or quantities. This Contractor shall field verify voltage and actual mounting condition and method.

J. Product samples complete with housing, trim, specified lumen package, and 8’ cord with plug for 120 V shall be submitted if requested.

1.5 CUSTOM LUMINAIRES

A. All custom luminaires require a prototype to be submitted prior to commencement of fabrication. The purpose of the prototype will be to review construction, LED placement within luminaire, LED type, optical assembly, finishes, etc. Modifications may be required as a result of prototype review. These modifications and others that do not materially affect the cost of the luminaire shall be incorporated at no additional cost to the Owner, Architect, or Engineer.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and luminaires to include in emergency, operation, and maintenance manuals.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authorities Having Jurisdiction, and marked for intended use.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Comply with NFPA 70.

E. Designated manufacturers are listed to define the requirements for quality and function of the specified product.

F. Mockups: Provide interior luminaires for room or module mockups complete with power and control connections.

1. Obtain Lighting Designer's and Architect's approval of luminaires for mockups prior to starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Remove mockups when directed. Luminaires may be reinstalled in the Work with approval from the University.
4. Install luminaires for mockups with power and control connections.
5. Mockups evaluated on the Project site may become part of the complete Work with the approval of the University, Lighting Designer and Architect if the mockup is undisturbed at the time of substantial completion.

1.8 COORDINATION

A. Coordinate layout and installation of luminaires with ceiling system and other construction that penetrates ceilings or is supported by them including mechanical system, fire suppression, and technology and partition assemblies.

B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation.

C. Recessed luminaires shall have frames that are compatible with the ceiling system indicated on the Architectural Drawings.

D. Coordination Meetings: This Contractor shall meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each luminaire mounting condition with ceiling type. During second meeting, coordinate luminaire layout in each area. This Contractor shall meet at least twice with the mechanical systems installer prior to fabrication and installation of ductwork. Coordinate depth and location of all luminaires with ductwork, fire suppression, and technology in all areas.

1.9 MAINTENANCE MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish two of each plastic lens type.

C. Furnish 10% of each type of driver type.

D. Furnish five (5) of each type of exit sign.

1.10 SUPPORT AND BRACING

A. All luminaires shall be installed with supports and bracing required for the seismic zone in which the project is located. See Spec Section 26 05 30.

B. Contractor to provide and install any hangars and supports to suspend or attach fixtures to locations as shown on reflected ceiling plans. Including any trapeze assemblies or special installation techniques to achieve installation in the desired locations. See all other project documentation for other systems that may conflict with traditional support methods.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Recessed Luminaires: Comply with NEMA LE 4 for ceiling compatibility for recessed luminaires.

B. Luminaires: Comply with UL 1598.

C. Metal Parts: Free of burrs, sharp corners and edges. Metal work shall be free of tool marks and dents and shall have accurate angles bent as sharply as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All miters shall be in accurate alignment with abutting intersection members.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging. Luminaires to be painted after fabrication. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.

E. Luminaire hardware to comply with the following material standards: For steel and aluminum luminaires, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel luminaires, all hardware shall be stainless steel.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Safety devices shall be detachable if necessary and shall not interfere with luminaire performance, maintenance or the seating of any luminaire element. Safety device shall not be visible during normal luminaire operation and from normal viewing angles.

G. Luminaires provided shall have means for disconnection from power source during service, as required in NEC Article 410.

H. Reflecting Surfaces: Minimum reflectance as follows, unless indicated otherwise:

1. White Surfaces: 85%
2. Specular Surfaces: 90%
3. Diffusing Specular Surfaces: 75%

I. Reflector cones shall adhere to the following:

1. Cones shall provide a minimum of 50-degree cutoff to source and source image.
2. Plastic material shall not be used for reflector cones.
3. Cones shall not be permanently fastened to the housing and shall be removable without tools. Retention devices shall not deform the cone or be visible from normal viewing angles.
4. Trim shall be flush to ceiling without gaps or light leaks. Where the flange trim is separate from the cone, it shall have the same finish as the reflector cone.
5. Reflector cones shall be uniform gauge, not less than 0.032” thick, high purity aluminum Alcoa 3002 alloy. Cones shall be free from spin marks or other defects.
6. Manufacture cones using the Alzak® process. Refer to Luminaire Schedule for cone color and finish, i.e., specular or diffuse requirements.

J. Lenses, Covers, Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100% virgin acrylic plastic. UV stabilized high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
    b. Lenses shall have uniform brightness throughout the entire visible area without LED pixelation.

2. Glass Globes: Annealed crystal glass unless otherwise indicated.

K. Adjustable luminaires shall have positive locking devices to fix aiming angle. Luminaires shall be capable of being relamped without adjusting aiming angle.

L. Each luminaire that has an array with a beam pattern or a spread lens that defines beam orientation shall contain locking devices to insure the orientation is not disturbed during array replacement or cleaning.

M. All luminaires and drivers shall operate within the temperature limits of their design and as specified by UL in the applications and mounting conditions specified.

N. Luminaires recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to NEC Article 300-22.

O. Provide plaster frame for recessed luminaires mounted in other than T-bar ceilings. Verify mounting with architectural reflected ceiling plan before ordering luminaires.

P. Fixtures installed in “hard” ceilings shall have all connections accessible through the luminaire.

Q. For weatherproof or vapor-tight installations, finishes of luminaires and accessories shall be a premium 5 stage TGIC polyester powder coat paint minimum 2.5 mils thick, applied to factory-assembled and -tested luminaires before shipping, so that the entire assembly is completely corrosion resistant for the service intended. Exterior finishes shall have an outdoor life expectancy of not less than 20 years without any visible rust or corrosion. Where aluminum parts come in contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.

R. Luminaires for use in areas designated as damp locations shall be suitable gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation openings. Dissimilar metals shall be separated by non-conductive material to prevent galvanic action.

S. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when light bars are in place.

T. Luminaires shall be free of light leaks while providing sufficient ventilation of LED’s and drivers to provide the required photometric performance.

U. Luminaires shall hold LED arrays securely against normal vibration and maintenance handling.

2.2 LED LUMINAIRES

A. Shall be tested according to the Illuminating Engineering Society of North America (IESNA) LM-79 and LM-80.

1. Shall supply third party testing and data in compliance with Commercially Available LED Product Evaluation and Reporting (CALiPER) or National Voluntary Laboratory Accreditation Program (NVLAP).
2. The testing laboratory must be listed on the U.S. Department of Energy's Solid-State Lighting website as an accredited testing laboratory.
3. Manufacturers shall provide supporting evidence of lamp life calculation based on junction temperature and drive current upon request.

B. Shall be listed and labeled in accordance with the U.S. Department of Energy Lighting Facts Program.

C. Shall provide independent test laboratories IES photometrics which verify light levels.

D. Correlated Color Temperature (CCT) measured in Kelvin's shall meet Nominal CCTs and tolerances as defined in ANSI_NEMA_ANSLG C78.377-2008.
1. Nominal CCT: 3000 K: 3045 ± 175 K or
2. Nominal CCT 3500 K: 3465 ± 245 K
3. Nominal CCT: 4000 K: 3985 ± 275 K or
4. Nominal CCT 4500 K: 4503 ± 243 K
5. Nominal CCT 5000 K: 5028 ± 283 K or
6. Nominal CCT 5700 K: 5665 ± 355 K
7. Nominal CCT: 6500 K: 6530 ± 510 K

E. Minimum CRI > 80 or as noted in the fixture schedule.

F. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.

G. Luminaires shall have internal thermal protection.

H. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

I. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management

J. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.

K. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.

L. Power Supplies and Drivers

1. Power Factor: 0.90 or higher
2. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
3. Output operating frequency: 60Hz.
4. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
5. Total Harmonic Distortion Rating: 20% Maximum.
6. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
7. Fully dimmable, 0 – 10 VDC standard.

8. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
9. Compatibility of dimming switches: Certified by manufacturer for use with individually specified luminaire and individually specified control components.

M. LED ARRAYS

1. All LED's of the same type are to be provided by the same manufacturer.
2. Equip each luminaire with the proper LED array of the type shown or specified in the Luminaire Schedule.

N. WIRING

1. No internal wiring shall be visible at normal viewing angles.

2.6 RECESSED LUMINAIRES

A. Furnish all recessed luminaires in compliance with U.L. Standards for:
   1. Suspended Ceilings Non-Type I.C.
      a. Where luminaire is used in a suspended ceiling.
   2. Thermally Protected Fixture - Non-Type I.C.
      a. Where luminaire is installed in a ceiling with the possibility of overheating.
   3. DC - IC Luminaire - Type I.C.
      a. Where luminaire is intended to be installed where direct contact with insulation is expected.

B. Check Architectural drawings, sections and specifications for insulation methods and ceiling types for additional information to determine the correct method to furnish luminaires for U.L. compliance.

2.7 STEMS

A. Ball aligned, swivel 30 or 45 degrees from vertical with swivel below canopy. Painted same color as luminaire trim unless otherwise noted.

2.8 EXIT LIGHTS

A. Exit lights furnished with 6" high stencil letters. Use green LED's. Verify color used with local codes, if a different color is required, indicate on the shop drawing submittal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Support of luminaires responsibility of this Section.

B. See Spec Section 26 05 30, Seismic Protection for Electrical Equipment for additional requirements.

C. Fixtures mounted in grid ceilings and in hard ceilings shall be supported independently of the ceiling or ceiling grid. See details on plans. For recessed fixtures in hard ceilings provide one support at each corner of 2' x 4' and larger luminaries and one at each end at opposite corners of 1' x 4' and 2' x 2' luminaries. In hard ceilings, galvanized hanger wires may be used.

D. Provide devices for securing luminaire to ceiling grid to comply with Article 410-16(c) of National Electrical Code. ("Earthquake Clips").

E. Wire luminaires with flexible conduit individually to junction boxes. Do not wire luminaire to luminaire.

F. Support recessed luminaires with 3/4" black iron ceiling channel, one piece on each side of luminaire, anchored to ceiling system. Support large recessed luminaires over 20 pounds independent of furred ceiling system with rods, size as required, anchored to structure.

G. Support surface and pendant luminaires from 3/8" fixture stud in outlet box. Large surface or pendant luminaires (in excess of 20 pounds) with 3/8" rod run through the outlet box to structure and anchored independent of ceiling and conduit systems.

H. Provide plaster frames for recessed luminaries in plaster and concealed spline ceilings supported independent of ceiling construction with 1/4" rod anchored to structure.

I. Individual flexible connections to luminaires shall be made with 2#14 and 1#14 (ground) THHN-2 in 3/8" flexible conduit not to exceed 6'. Bond ground wire at each end. Provide additional wire(s) as required for a/b and similar switching schemes.

J. Stems on linear luminaires shall be installed as follows (except luminaires with slide grip hangers): First and last stem in row shall be installed in first knockout from end of luminaires; one stem shall be installed between each two luminaires connect intermediate stems to center joint where luminaires join and attach by use of "joining plates". Provide adequate number of stems to completely support luminaires and keep luminaires aligned straight and plumb.

K. Connect luminaires in continuous rows other than recessed grid type connected by nipples with locknuts and bushings.

L. Furnish complete manufacturers shop drawing for continuous luminaires showing mounting, ceiling interface and complete luminaire layout.

M. Refer to architectural reflected ceiling plans for coordination of luminaire locations with mechanical, fire protection, technology and fire safety equipment. Where conflicts occur, coordinate with Architect, Engineer and Lighting Designer prior to installing any of the Systems.

N. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

O. Luminaires located in recessed ceilings with a fire resistive rating of 1 hour or more shall be enclosed in an approved fire resistive rated box equal to that of the ceiling. Acoustical ceiling tiles are not acceptable.

P. Install recessed luminaires to permit removal from below.

Q. Install recessed luminaires where installed in rated assemblies using accessories and firestopping materials to meet regulatory requirements for fire rating.

R. Install wall-mounted luminaires at height as indicated on Drawings.

S. Remote mounting of drivers: Distance between the driver and fixture shall not exceed that recommend by manufacturer. Verify the maximum distance between the driver and luminaire with the manufacturer.

T. Pendant Mounted Fixtures

1. Where suspended below accessible ceiling, provide structural support at suspended ceiling level from structural members above ceiling. Do not run hanger rods through ceiling.
2. Continuous Runs of Luminaires: Laser sight to insure luminaires are straight and true when sighting from end to end, regardless of irregularities in the ceiling. Where luminaires are so installed, omit ornamental ends between sections. All seams/joints shall be tightly fitted.
3. All power feeds shall originate from the same location/end of each run.

U. Install accessories furnished with each luminaire.

V. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

W. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.2 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Aim and adjust luminaires as indicated on Drawings.

3.4 CLEANING AND ADJUSTING

A. Remove protective plastic covers from luminaires and luminaire diffusers only after construction work, painting and clean-up are completed. Remove, clean, and reinstall all dirty reflectors and diffusers.

B. Clean luminaires internally and externally after installation. Use methods and materials recommended by manufacturer for cleaning Alzak reflectors and other surfaces.

C. Make final adjustment of aimable luminaires and adjustable light settings under the direction of the Architect and/or Lighting Designer during a scheduled period of time prior to the completion of the Project, after normal business hours if required. Include all equipment and personnel expenses including overtime required for focusing.

3.5 PROTECTION OF FINISHED WORK

A. General Conditions: Protecting finished work.

B. Replace all inoperable LED arrays at the end of construction prior to substantial completion.

3.6 GUARANTEE

A. All luminaires, components, accessories etc., shall be guaranteed against defects in materials and workmanship for five (5) years from date of in-service acceptance by owner. Replacement shall include parts and labor at the site of the work for the term of the warranty.

3.6 PROJECT CLOSEOUT

A. The contractor and lighting representative shall demonstrate maintenance procedures for replacement and renewal of each individual fixture type with facilities maintenance staff upon project completion. The contractor shall remove and re-install each replaceable component within each fixture type in the presence of the owner.

END OF SECTION 26 51 00

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section provides general requirements for a complete and fully operational Exterior Lighting System including:

1. Exterior Luminaires
2. Accessories
3. Luminaire supports
4. Poles
5. LED Arrays
6. Controls
7. Standard Fixture Schedule

B. Related Sections:

1. Section 26 05 19 Low Voltage Electrical Power Conductors and Cables.
2. Section 26 05 26 Grounding and Bonding for Electrical Systems

1.3 SYSTEM DESCRIPTION

A. Catalog numbers indicated in the Luminaire Schedule are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of LED, driver, finish trim, mounting hardware or special requirements as specified or as required by the particular installations. Provide complete luminaire to correspond with the features, accessories, number of LED's, wattage and/or size specified in the text description of each luminaire type, as well as performance requirements outlined in Lighting Control Sequence of Operation. Additional features, accessories and options specified shall be included.

B. Luminaire voltage shall match the voltage of the circuit serving same.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed of calculating wind load for poles 50 feet (15 M) high or less is 105 MPH. See details on plans.

    a. Wind Importance Factor: 1.3.
    b. Minimum Design Life: 25 years.
    c. Wind induced vibration.

1.6 SUBMITTALS

A. SUBSTITUTIONS

1. See General Conditions of the specifications for information regarding substitutions. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples if requested by Engineer are provided. Alternate products shall meet or exceed design criteria.
2. If submitted fixtures are not as specified, provide footcandle calculations showing the actual site plan. Provide IES files in digital format of all substituted fixtures to the Engineer for review.

B. The authorized manufacturer's representative for the Project area shall prepare Submittals for each luminaire type. In addition to the luminaire Submittals, a list shall be provided identifying the manufacturer representative for each luminaire type. Provide manufacturers' names, addresses, and telephone numbers. Requests for prior approval shall also include this information. Submittals or requests for prior approval without this information will be rejected.

C. Product Data shall indicate that luminaire, LED arrays, and drivers fully comply with Contract Documents. Data shall be submitted for each type of luminaire indicated, arranged in order of luminaire designation. For standard catalog luminaires provide original product catalog sheets indicating data on features, accessories, finishes, and the following:

1. Materials and dimensions of luminaires.
2. Photometric data, in IESNA format, based on certified results of laboratory tests of each luminaire type, outfitted with LED arrays, drivers and accessories identical to those indicated for the luminaire as applied in the Project.

    a. Photometric data shall be certified by a qualified independent testing agency.
    b. Foot-candle map including existing fixtures' contributions

3. Low voltage transformers.
4. LED power supplies.
5. Types of LED's, including manufacturer, wattage, and Color Rendering Index (CRI) and color temperature in degrees Kelvin (K).
6. Wireless controls: nodes, gateways, modems, and server.

D. Shop Drawings shall:

1. Show details of nonstandard or custom luminaires.
2. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
3. This Contractor shall provide the manufacturer with accurate field dimensions where required.
4. Include wiring diagrams, power and control wiring.

E. Wiring Diagrams shall detail wiring for luminaires and differentiate between manufacturer-

installed and field-installed wiring.

F. Product Certificates shall be signed by manufacturers of luminaires certifying that products comply with requirements.

G. Maintenance Data shall be provided for luminaires and equipment to include in emergency, operation, and maintenance manuals Specified in Specifications Section describing Operations and Maintenance Data.

H. Field quality control test reports.

I. Special Warranties Specified in this Section.

J. Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall not be considered to be approval of said voltage, mounting condition, or quantities. This Contractor shall field verify voltage and actual mounting condition and method.

K. Product samples complete with housing, trim, specified lumen package, and 8’ cord with plug for 120 V shall be submitted if requested.

L. Pole and Support Component Certificates: Signed by Manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a Professional Engineer.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and luminaires to include in emergency, operation, and maintenance manuals.

1. Provide a list of all driver types used on Project; use ANSI and manufacturers' codes.
2. Submit site map showing dimensioned locations of all exterior lighting fixtures and poles with labels. Also show stubbed-out spare conduits, in-ground junction boxes, and underground sleeves. Indicate dimensioned locations of sleeve ends, conduits, and junction boxes from a permanent building or landscape feature. Circuit numbers for all loads shall be shown. Electronic files of site lighting maps be provided at Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Glass, Plastic Diffusers and Lenses: 10% or one dozen (whichever is less) of each type and rating installed. Furnish at least one of each type.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Package poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle with web fabric straps.

1.10 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Authorities Having Jurisdiction, and marked for intended use.

C. Comply with IESNA TM-15-11 and Addendum A for Backlight, Uplight, and Glare (BUG) ratings.

D. Comply with ANSI C7.3777.208 Standards for chromaticity of SSL products.

E. Comply with NFPA 70.

F. All luminaires shall bear a UL or ETL label.

G. Comply with IEEE C2, “National Electrical Safety Code.”

H. Designated manufacturers are listed in the Luminaire Schedule to define the requirements for quality and function of the specified product.

1.11 COORDINATION

A. Coordinate layout and installation of luminaires with plantings, paving, site walls, other site work elements, and existing luminaires.

B. Coordination Meetings: This Contractor shall meet at least twice with the sitework installer(s). Hold first meeting before submittal of shop drawings to coordinate each luminaire mounting condition and location. During second meeting, coordinate layout with other site components. Coordinate depth and location of all luminaire pole bases in all areas.

1.12 WARRANTY

A. Comply with Division 1 requirements.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Fixture, including the LEDs, drivers and electrical components: Five years from date of Certificate of Occupancy.
2. Warranty Period for housing paint and finish: Five years from date of Certificate of Occupancy.
3. Warranty Period for Color Retention: Five years from date of Certificate of Occupancy.
4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less five years from date of Certificate of Occupancy.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on

Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall be listed and labeled for installation in wet locations.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Comply with IESNA TM-15-07 Luminaire Classification System for Outdoor Luminaires.

D. Metal Parts: Free of burrs and sharp corners and edges.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit easy replacement of drivers. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

H. Optical assemblies: where specified, full cutoff with zero uplight, “dark sky” compliant. LED assemblies shall comply with IESNA BUG rating system.

I. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses in luminaire doors.

2.3 LED DRIVERS AND ARRAYS

A. UL 1598 listing.

1. Lumen Depreciation Data: maintain greater than 95% lumen maintenance at 60,000 hours per IES TM-21.
2. LED color: neutral white, 4000 deg K, minimum CRI of 70, or as scheduled on the drawings.

B. LED arrays shall have an IP66 enclosure rating.

C. Power supply / driver shall be field replaceable by means quick-disconnect connectors and easy access mounting hardware.

D. Drives shall accept 120 – 277 volts or 480 volts, 60 Hz.

E. Power Factor > 0.9@ full load.

F. THD < 20% @ full load.

G. Surge protection: 10kA/10kV per ANSI/IEEE C136.2-2014

H. The housing shall have an integral thermal management system with extruded aluminum radiation fins and lateral airways for passive cooling, no devices using moving parts are

permitted.

I. Minimum starting temperature: minus 30 deg C, 40 deg C ambient.

J. Comply with IES LM-79-08 and LM-90-08 Approved Methods.

2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Minimum clear opening of 2-1/2 by 5 inches with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 3 Concrete Sections.

2.5 STEEL POLES

A. Poles: Seamless, extruded structural tube complying with ASTM 1A123/A123M hot-dipped galvanized steel, unless noted otherwise, and with access handhole in pole wall.

1. Shape: Refer to Luminaire Schedule or shall match existing site poles.
2. Mounting Provisions: Butt flange for bolted mounting on foundation.

B. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

C. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

D. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast steel. Adapter fitting welded to pole and bracket, and then bolted together with stainless-steel bolts or high strength galvanized carbon steel.

1. Finish: Match pole and luminaire material and finish.

E. Steel Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish: Premium five (5) stage TGIC polyester powder coat paint.

a. Color: As selected by Architect from manufacturer's full range or to match existing adjacent poles.
b. Pole finish shall match that of fixture head finish.

2.6 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

B. Fusing: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by driver manufacturer. Fuseholders shall be completely waterproof and shall grip the fuse in the load side section when opened. The circuit shall be fused in the base of the pole and accessible through the handhole.

C. Wind Mitigation Devices/Vibration Dampener: Provide for all site poles.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

B. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

1. Provide house side shields where necessary to control spill light.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 3 Concrete Sections.

C. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space.
2. Install base covers unless otherwise indicated.
3. Use a short piece of 1/2-inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

D. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD AND INDIVIDUAL GROUND MOUNTED LUMINAIRES

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3 Concrete Section.

3.4 CORROSION PREVENTION

A. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 GROUNDING

A. Ground metal poles and support structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
3. Provide a continuous grounding conductor in all exterior lighting circuits.

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Replace all burned out or inoperative LED arrays at the end of Construction prior to Certificate of Occupancy.

C. Advance Notice: Give dates and times for field tests.

D. Provide instruments to make and record test results.

E. Test as follows:

1. Verify proper operation, switching and phasing of each luminaire after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation. Verify normal transfer to generator and retransfer to normal.
3. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to the lighting system, retest to demonstrate compliance with standards.

F. Malfunctioning Luminaires and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

G. Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

END OF SECTION 26 56 00

SECTION 26 60 00 – ELECTRICAL SYSTEMS TESTING

PART 1 – GENERAL

A. The Contractor shall retain the services of an independent testing firm to perform International Electrical Testing Association (NETA) testing. Testing services shall be as described in this specification and shall be paid for and coordinated by the Contractor.

B. NETA testing procedures and requirements for tested values shall be in accordance with the most current edition of the NETA Acceptance Testing Specifications.

C. Any deficiencies or failures discovered during the NETA testing procedures shall be promptly corrected by the Contractor to ensure timely completion of the project and to minimize the time required for the independent testing firm to complete their work.

D. Independent testing firms shall be as listed below or approved equal.

A.Nat'l Field Services
B.Electrical Professional Consultants
C.Electrical Reliability Services | Vertiv

1.1 TEST REPORTS

A. Intermediate Test Reports

1. Intermediate test reports shall be issued by the independent testing firm immediately following each site visit. Intermediate test reports shall identify the general results of all field testing and field observations, and shall specifically identify any deficiencies, problems, or failures noted during the site visit.

2. Intermediate test reports shall be issued/distributed to the electrical subcontractor, the general contractor, the electrical engineer, and to the Owner. The intent of this direct communication and/or notification to multiple parties is to ensure the 'independent' function of the independent testing firm and to prevent such information from being delayed or filtered by processing it through the electrical subcontractor and/or the general contractor.

B. Final Test Report

1. The final test report shall be issued by the independent testing firm following successful completion all required electrical systems testing. The final test report shall be typed, bound, and indexed, and shall include a cover page that identifies the project name, project location, and project number. The final test report shall include a separate section for each area of required testing (tests as summarized below).

a. Grounding Systems
b. Ground Fault Protection Systems
c. Circuit Breakers (Over 100 Amps)
d. Transformers (Dry Type)
e. Low Voltage Feeders (up to 600 Volts) Serving Loads of 100 Amps or Greater
f. Main Switchboard
g. Distribution Boards
h. Branch Circuit Panelboards

1.2 TESTING REQUIREMENTS

A. Grounding Systems

1. The following grounding system testing shall be conducted on two separate occasions, once prior to initializing electrical power for construction activities, and once when all electrical systems have been finalized.
2. Perform fall-of-potential testing of the main grounding electrode or grounding system in accordance with IEEE Standard No. 81. If suitable locations for test rods are not available, a low resistance dead earth or reference ground shall be utilized.
3. Perform point-to-point testing to determine the resistance (bonding) between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.
4. Measure system neutral-to-ground insulation resistance with the neutral disconnect link temporarily removed (replace neutral disconnect link after testing).
5. This testing shall be performed at the origination point of all separately derived systems.
6. Verification shall be made that the grounding electrode system is installed per NEC at all connection points.

B. Ground Fault Protection Systems

1. Perform pickup tests utilizing primary injection. Verify that the relay does not operate at 90% of the pickup setting. Verify pickup is less than 125% of setting or 1200 amps (whichever is less).
2. On summation type systems utilizing phase and neutral current sensors verify correct polarities by applying current to each phase-neutral current transformer pair).
3. Measure time delay of the relay at 150% of pickup or greater by injecting current into the sensor. Total trip time shall be electronically monitored.
4. Verify that the reduced control voltage tripping capability is 55% of rated voltage for systems with external control power (reference UL-1053).
5. Test zone interlock systems by simultaneous sensor current injection and monitoring of zone blocking function.

C. Circuit Breakers (Over 100 Amps)

1. Test requirements apply to adjustable molded case, insulated case, and metal frame circuit breakers.
2. Measure contact resistance by millivolt drop method at rated current or by digital low resistance ohmmeter method.
3. Test insulation resistance from pole-to-pole and from pole-to-ground with breaker closed and across open contacts of each phase.
4. Adjust trip settings in accordance with coordination study.
5. Measure instantaneous pickup current by primary current injection.
6. Measure long-time pickup and delay by primary current injection.
7. Measure short-time pickup and delay by primary current injection.
8. Verify trip unit reset operation.

D. Transformers (Dry Type)

1. Test insulation resistance winding-to-winding and winding-to-ground and calculate the polarization index.
2. Test turns ratio between windings for all tap positions. Verify that winding polarities match the transformer nameplate.
3. Measure resistance of each high voltage winding in each no-load tap-changer position. Also measure resistance of each low voltage winding in each load tap-changer position (when applicable).

E. Low Voltage Feeders (up to 600 Volts) Serving Loads of 100 Amps or Greater

1. Conduct megohm (Megger) testing of shield continuity resistance utilizing a megohmmeter.
2. Test insulation resistance phase-to-ground and phase-to-phase for one minute.
3. Test voltages shall be as recommended by the feeder manufacturer (or by NETA Acceptance Testing Specification).

F. Main Switchboard

1. Review cable testing report for each conductor.
2. Record all circuit breaker settings and very that each setting is in accordance with the coordination study.
3. Test and verify the accuracy of the load meter in each function and verify values can be seen on the campus control system.
4. Test and verify the operation of the shunt trip mechanism.
5. Inspect installation and functions of the surge suppression device and verify SPD lengths are as short as possible.

G. Distribution Boards

1. Review cable testing report for each conductor.
2. Record all circuit breaker settings and very that each setting is in accordance with the coordination study.
3. Inspect installation and functions of the surge suppression device and verify SPD lengths are as short as possible.

H. Branch Circuit Panels

1. Review cable testing report for each conductor.
2. Record all circuit breaker settings and very that each setting is in accordance with the coordination study.

END OF SECTION 26 60 00

SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. Include all labor, materials, tools, transportation, storage costs, excavation, training, equipment, insurance, temporary protection, permits, inspections, taxes and all necessary and related items required to provide complete and operational telecommunications, video surveillance, and clock/paging systems as shown on the Drawings and described in the Specifications. Access-control and intrusion-detection work is limited to existing systems or rough-in where specifically shown on the Drawings; active access-control and intrusion-detection equipment, programming, and commissioning are not included unless expressly indicated.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 05 43: Exterior Communications Pathways
4. 27 08 00: Commissioning of Communications
5. 27 11 00: Communications Equipment Room Fittings
6. 27 13 00: Communications Backbone Cabling
7. 27 15 00: Communications Horizontal Cabling
8. 27 51 13: Paging Systems
9. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 QUALITY ASSURANCE

A. The Contractor installing communications cabling and termination equipment shall have a minimum of (5) years experience installing communications systems of similar size and scope.

B. The Contractor must be licensed by the Nevada State Contractors Board.

C. Formal, written evidence of the following shall be presented to the WCSD Project Manager during the BID process and before contract is awarded:

1. The Contractor, including any subcontractor, must have BICSI® Registered Installers and Technicians on staff and assign them to the Project. The project shall be staffed at all times by Installers and Technicians who, in the role of lead craftsperson, shall be able to provide leadership and technical resources for the

remaining craftspersons on the project. At all times, a minimum of 30 percent of on-site Contractor personnel shall be BICSI® registered communications installers. The Field Supervisor must be a BICSI® Technician or RCDD.

2. If requested, the Contractor, including any subcontractor, shall show proven expertise in the implementation of communications projects including details of at least three projects involving the design and installation of Category 6 unshielded twisted-pair cabling systems and optical fiber cabling systems within the past two year period. Names, addresses, and telephone numbers of references for the three projects shall be included.
3. The Contractor shall accept complete responsibility for the design, installation, acceptance testing and certification of the Belden 10GX, 2400 and/or IBDN FiberExpress System. Objections to the design shown on the Drawings and Specifications shall be made prior to bidding the project.
4. In the event subcontractors are used for any portion of the installation or acceptance testing, The Contractor shall be responsible for any subsequent corrective action required on that portion.

D. Manufacturer Product Data Sheets

1. Submit product data sheets in electronic PDF (portable document format).
2. Provide table of contents for each submittal indicating the items being submitted. Products listed in the table of contents should be in the same order as they appear in the Specifications.
3. Provide product data sheets for all items listed in each specification section. Partial submittals will not be accepted.
4. Where product data sheets include more than one distinct item, clearly mark data sheet with arrow or other identifying means to indicate the items being submitted for approval. Delete or cross-out all non-applicable data.

E. Shop Drawings and Coordination Drawings

1. Submit shop drawings and coordination drawings in electronic PDF (portable document format).
2. Shop drawings and coordination drawings shall bear the stamp of approval of the Communications Contractor as evidence that they have checked the drawings. Drawings submitted without this stamp of approval will not be considered and will be returned for proper resubmission. All shop drawings shall be submitted as a single complete package. Partial packages will not be reviewed.
3. Shop drawings and coordination drawings must be submitted and approved prior to the installation of the work. Installation of work prior to the submittal and approval of the shop drawings will proceed at the contractor’s risk.
4. See individual Division 27 specification sections for specific shop drawing and coordination drawing requirements. At a minimum, drawings shall be submitted for the following items:

    a. Routing of conduits 2” and larger.
    b. Routing of basket tray and or cable tray.
    c. Routing of telecom cable pathway in telecom equipment rooms.
    d. Layout of floor and wall mounted equipment in telecom equipment rooms.

F. Cable Test Reports

1. Submit test reports signed and dated by the technician performing the cable testing.

G. Retain communications work for video surveillance, clock/paging, AV, and structured cabling as shown and as coordinated with WCSD-SCS-015. (dated March 13, 2023)

H. Access control and intrusion detection are not active system scopes under this Section, except for rough-in and existing-system coordination where specifically shown on the Drawings.

I. Other Submittals

1. See individual Specification Sections for requirements.

1.4 REGULATIONS AND CODE COMPLIANCE

A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and Local applicable codes and ordinances.

B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

C. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations of the telecommunications industry, as well as federal, state and local governmental agencies, including, but not limited to the following:

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
4. ANSI/TIA-568.3-E: Optical Fiber Cabling and Component Standard (Revision E, September 2022).
5. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
6. ANSI/TIA-598-D: Optical Fiber Cable Color Coding (Revision D, July 2014).
7. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
8. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
9. ANSI/TIA-758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard (Revision B, March 2012).
10. ANSI TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (Revision A, July 2015).
11. ANSI/TIA-526-14-C: Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant (Revision C, 2015).
12. ANSI/TIA-1152-A: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling (Revision A, November 2016).
13. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
14. Underwriter’s Laboratories, Inc. (UL).
15. Federal Communications Commission (FCC).
16. Americans with Disabilities Act (ADA).

17. Washoe County School District Structured Cabling System Standard WCSD-SCS-015 dated March 13, 2023, as referenced on the Project Drawings.

1.5 DEFINITIONS

A.	Accessible Ceiling	Space above a ceiling constructed of removable tiles (clipped or unclipped). Acoustical ceiling grid with removal tiles would be considered an accessible ceiling. A gypboard ceiling would not be considered an accessible ceiling.
B.	Approved/Approval	Written permission to use a material or system.
D.	As Called For	Materials, equipment including the execution specified/shown in the Specifications.
D.	Code Requirements	Minimum requirements.
E.	Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
F.	Exposed	Work not identified as concealed.
G.	Final Acceptance	Owner acceptance of the project from the Contractor upon certification by the Owner's Representative.
H	Furnish	Supply and deliver to installation location.
I.	Furnished by Others	Receive delivery at job site or where called for and install.
J.	Inspection	Visual observations by Owner or Owner's Representative.
K.	Install	Mount and connect equipment and associated materials ready for use.
L.	Listed	Refers to classification by a standards agency.
M.	Or Approved Equal	Approved equal or equivalent as determined by Owner or Owner's Representative.
N.	Owner's Representative	Design professional or Consultant representing the Owner.
O.	Provide	Furnish, install and connect ready for use.
P.	Relocate	Disassemble, disconnect, and transport equipment to new locations: then clean, test, and install ready for use.
Q.	Replace	Remove and provide new item.
R.	Review	A general contractual conformance check of specified products.

S. Satisfactory — As specified in Specifications.

1.6 INTENT OF DRAWINGS

A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner's Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy

B. Items mentioned in the Specifications and not shown in the Drawings, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner's Representative shall govern.

C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.

D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.7 REVIEW OF SPECIFICATIONS

A. The Contractor shall carefully study and compare the Drawings and Specifications. Any error, inconsistency or omission discovered shall be immediately reported to the Owner or Owner's Representative. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.

1.8 EXAMINATION OF THE PREMISES

A. The Contractor shall visit the Site to become familiar with the local conditions under which the work is to be performed and correlate the observations with the requirements of the Drawings and Specifications. No allowance will be made for claims of concealed conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.

B. Before ordering any materials or performing any work, the Contractor shall coordinate the installation with the work of other trades and shall verify all measurements. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.9 COORDINATION OF TELECOM CABLING PATHWAYS AND TELECOM EQUIPMENT ROOMS

A. The telecom drawings are diagrammatic in depicting the routing of communications pathways and the layout of communications equipment.

B. The contractor shall coordinate the installation of all telecom work with the work of other trades including Mechanical, Electrical, Plumbing, Sprinkler, Structural and Architectural.

C. The contractor shall participate in coordination meetings with other trades prior to the installation of the work. For a specific space/area, the telecom contractor shall coordinate the routing and installation of all telecom work with all other trades that have work in that specific space/area.

D. Prior to the installation of telecom cabling pathway including conduit, basket tray, cable tray, ladder rack, sleeves, etc., the contractor shall coordinate the routing of this pathway to avoid conflicts with and provide necessary clearances from the work of other trades. The contractor shall provide all horizontal offsets, vertical offsets and radius bends as necessary to coordinate the routing of the telecom pathway with the work of other trades and building structure.

E. Prior to the installation of equipment and/or cabling in the communication rooms, the contractor shall coordinate the layout of all equipment and cable pathways. The contractor shall submit shop drawings for approval of each room. At a minimum, the following information shall be included on the shop drawings:

1. Layout of all floor mounted equipment including racks, cabinets and uninterruptible power supplies. Drawings shall show the required clearances with dimensions in the front, rear and side of all floor and wall mounted equipment.
2. Layout of all floor mounted sleeves and cable openings.
3. Layout of horizontal and vertical ladder rack.
4. Layout of light fixtures, HVAC equipment and ductwork serving the room. Coordinate the layout of this equipment with the overhead cable pathways.
5. Provide elevations of each wall showing the location of all wall mounted equipment including racks, ground bars, electrical panels, electrical outlets, wall mounted termination equipment, cable slack storage rings, security panels, etc.

1.10 WARRANTY AND SERVICES

A. The installed Belden 10GX, 2400, and/or FiberExpress System shall be covered by a certification program provided by BELDEN/CDT and the Certified System Vendor (Contractor).

B. All Contractor-installed cabling shall be certified as per BELDEN/CDT requirements for the Belden 10GX, System 2400, and/or FiberExpress System. Any requirements for Belden Certification not specified within the Plans and Specifications but necessary for certification are assumed.

C. Lifetime Application Assurance

1. Belden certification shall provide the assurance that all present and future applications engineered for the performance level of the cabling system used shall work for the lifetime of the certified Belden 10GX, System 2400, and/or FiberExpress System.
2. Should the certified Belden 10GX, System 2400, or FiberExpress System fail to support the application(s) designed to operate over it—whether at the time of cutover to the new cabling system, during subsequent use, or after upgrading to a newer supported application (for example, to a Gigabit Ethernet or an ATM network from a lower-speed network environment)—BELDEN/CDT and The Certified System Vendor (Contractor) shall take prompt corrective action.

D. 25-Year Product Warranty

1. Belden certification shall provide a twenty-five (25) year product warranty for all Belden passive components used in the installed Belden 10GX, System 2400,

and/or FiberExpress System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. Electrical equipment and systems shall meet UL Standards and requirements of the National Electric Code. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the Specifications shall be performed in accordance with these requirements.

B. Equipment shall meet all applicable FCC Regulations.

C. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.

D. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or cataloged item of equipment. All equipment and systems must conform to the Specifications.

2.2 WORKMANSHIP, SUBSTITUTIONS, WARRANTY

A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for a minimum of one (1) year from the date of final acceptance. Cable integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed free from defects, transpositions, open shorts, tight kinks, damaged jacket insulation, etc.

B. Refer to the individual Division 27 Specifications for additional and/or extended warranty requirements.

C. All labor must be thoroughly competent, skilled and trained, and all work shall be executed in strict accordance with the best practice of the trades.

D. The Contractor shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, improper installation or poor workmanship.

E. After the Contract is awarded, requests to substitute for specified materials shall be submitted by the Contractor to the Owner or Owner’s Representative within thirty (30) days, complete with reasons for the substitution and savings which accrue to the Owner if the substitutions are approved. Substitutions after Contract award will be considered only if the substitutions are equal or superior to the products specified.

F. No material substitutions will be allowed except by written acceptance from the Consultant. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples are provided.

G. Approval of alternate or substitute equipment or material in no way voids the Specification requirements.

H. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submit to the Owner or Owner’s Representative all evidence to support the contention

that the item proposed for substitution is equal to the specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.

2.3 FACTORY ASSEMBLED PRODUCTS

A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit need not be products of the same manufacturer.
2. Component parts, which are alike, shall be from a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Components of equipment shall bear the manufacturer's name or trademark model number and serial number on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

B. Major items of equipment that serve the same function must be the same make and model.

C. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.

D. Maximum standardization of components shall be provided to reduce spare part requirements.

PART 3 – EXECUTION

3.1 ROUGH-IN

A. Before construction work commences, the Contractor shall visit the site and identify the exact routing of horizontal and backbone cable pathways.

B. All equipment locations and cabling pathway shall be coordinated with other trades and existing conditions to eliminate interference with required clearances for equipment maintenance and inspections.

C. Coordinate work with other trades and existing conditions to determine exact location of equipment and routing of cable pathways.

1. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. If, after installation of any equipment, piping, ducts, conduit, etc., it is determined that adequate space has not been provided for passage or maintenance, rearrange the work. Any changes in the size or location of the material or equipment supplied or proposed, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

D. Provide easy, safe and code mandated clearances at equipment racks and enclosures.

3.2 CUTTING, CORING AND PATCHING

A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the communications cabling pathway system.

B. Protect existing finishes from water damage during core/cutting work and cleanup all related water and debris. Patch adjacent work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.

C. Contractor to submit all proposed concrete wall or floor penetrations to the Structural Engineer for approval prior to performing the work. Contractor shall locate and avoid cutting concrete reinforcing steel using current x-ray or pachometer equipment.

3.3 FIRESTOPPING

A. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

B. Firestopping assemblies shall meet or exceed the rating of the wall or floor being penetrated.

C. Fire stopping References:

1. ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.
2. ASTM E 119, Fire Tests of Building Construction and Materials (for fire-rated architectural barriers).
3. 2023NFPA National Electrical Code, Spread of Fire and Products of Combustion.

3.4 CONCEALMENT

A. Telecom cabling pathways including conduit, sleeves and tray shall be concealed above ceilings, in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, or in areas without ceilings, the Owner’s Representative shall be notified of the proposed routing prior to starting that portion of the work.

B. All telecom cabling must be routed concealed above accessible ceilings or in conduit. No exposed telecom cabling is permitted with the exception of telecom cabling routed within the telecom rooms.

3.5 CONDUIT SEALING

A. All penetrations through slab-on-grade and concrete-filled metal decks to be sealed watertight. See Section 07 92 00 – Joint Sealants.

B. The Contractor shall seal all foundation penetrating conduits and all service entrance conduits and sleeves to eliminate the intrusion of moisture, gases and rodents into the building. This requirement also applies to spare conduits.

C. Spare conduits shall be plugged with expandable plugs.

D. All service entrance conduits shall be sealed or resealed after cable installation.

3.6 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

B. Where mounting heights are not dimensioned, install systems, materials and equipment to provide the maximum headroom possible.

C. Set all equipment to accurate line and grade, level all equipment and align all equipment components.

D. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises.

E. No equipment shall be hidden or covered up prior to inspection by the Owner's Representative. All work that is determined to be unsatisfactory shall be corrected immediately.

F. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

G. The Contractor shall replace all ceiling tiles damaged by work performed as part of the communications contract.

H. Storage and security of material and equipment shall be the responsibility of the Contractor.

END OF SECTION 270500

SECTION 27 05 26 – BONDING AND GROUNDING FOR COMMUNICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK:

A. Section Includes:

1. Communications rooms bonding busbars and associated mounts.
2. Rack bonding busbars.
3. Bonding conductors.
4. Bonding connectors.
5. Labeling of bonding and grounding system.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 01 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 05 43: Exterior Communications Pathways
4. 27 11 00: Communications Equipment Room Fittings
5. 27 13 00: Communications Backbone Cabling

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Contractor shall comply with all applicable governmental regulations including Federal, State, City, and Local applicable codes and ordinances.

B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

C. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations of the telecommunications industry, as well as federal, state and local governmental agencies, including, but not limited to the following:

1. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
2. ANSI/NFPA-70, 2023 -- National Electrical Code (NEC).
3. Underwriter’s Laboratories, Inc. (UL).

1.4 DEFINITIONS

A. PBB: Primary Bonding Busbar
B. SBB: Secondary Bonding Busbar
C. RBB: Rack Bonding Busbar
D. TBC: Telecommunications Bonding Conductor

E. TBB: Telecommunications Bonding Backbone
F. BBC: Backbone Bonding Conductor
G. TEBC: Telecommunications Equipment Bonding Conductor
H. AWG: American Wire Gauge

1.5 SYSTEM DESCRIPTION

A. Provide each communications room with a primary or secondary bonding busbar (PBB/SBB) for equipment bonding. See drawings for busbar types, sizes and locations.

B. Provide minimum #3/0 AWG green insulated telecommunications bonding conductor (TBC) from the primary bonding busbar (PBB) to the electrical panel/service ground serving the communications room.

C. Provide minimum #3/0 AWG green insulated bonding conductor from each primary and secondary bonding busbar (PBB/SBB) to the electrical panel/service ground serving the communications room.

D. Provide minimum #3/0 AWG green insulated bonding conductor from each primary and secondary bonding busbar (PBB/SBB) to building steel. CAD weld bonding conductor to building steel.

E. Provide a rack bonding busbar (RBB) at the top of each rack/cabinet located in the communications room. Bond RBB to equipment rack with #6 AWG green insulated bonding conductor. Bond each RBB to PBB/SBB with dedicated #6 AWG green insulated rack bonding conductor (RBC).

F. Bond sections of overhead ladder rack together in the communications room with a #6 AWG green insulated bonding jumper.

G. Bond the following miscellaneous items in the communications room to the PBB/SBB with a #6 AWG green insulated bonding jumper.

1. Building entrance terminals/surge protection devices connected to outside plant copper cabling.
2. Backbone conduit.
3. Backbone copper cable shields.

1.6 SUBMITTALS

A. Product Data:

1. Primary and Secondary bonding busbars (PBB/SBB).
2. 2-hole compression type grounding lugs.
3. Overhead ladder rack bonding jumpers.

1.7 CLOSEOUT SUBMITTALS

A. Test Results:

1. Result of the ground-resistance test, measured at the point of TBC connection.
2. Result of the bonding-resistance test at each SBB and its nearest grounding electrode.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: Currently registered by BICSI as ITS Installer 2 to perform the on-site inspection.

PART 2 – PRODUCTS

2.1 GENERAL

A. Grounding Connection Accessories:

1. Electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type of service required.

B. Exothermic welded connections are required where grounding conductors connect to underground grounding conductors and to underground grounding electrodes, and for bonding to steel. All underground connections shall be exothermic welded.

C. All ground wires shall be copper except where stainless steel is specified for manholes, sized according to the NEC or as shown on the drawings whichever is larger.

2.2 SYSTEM COMPONENTS

A. Comply with TIA-607-D.

2.3 BONDING CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Harger Lightning and Grounding.
2. Panduit Corp.
3. Tyco Electronics Corp.
4. Or approved equal.

B. Comply with UL 486A-486B.

C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Telecommunications Bonding Conductor (TBC) from primary bonding busbar (PBB) to main electrical service ground shall be #3/0 AWG.
2. Telecommunications Bonding Backbone (TBB) from primary bonding busbar (PBB) to secondary bonding busbars (PBB's) shall be #3/0 AWG.
3. Bonding conductor from secondary bonding busbar (SBB) to electrical panel serving room shall be #3/0 AWG.
4. Bonding conductor from primary bonding busbar (PBB) and secondary bonding busbar (SBB) to building steel shall be #3/0 AWG.

5. Bonding conductor from equipment racks/cabinets to PBB/SBB shall be #6 AWG.
6. Bonding jumpers between sections of communications room overhead ladder rack shall be #6 AWG.
7. Bonding conductor from overhead ladder rack to PBB/SBB shall be #6 AWG.

D. Cable Tray/Wire Basket Tray Grounding Jumper:

1. Not smaller than No. 6 AWG 26 kcmils (13.3 sq. mm) and not longer than 12 inches (300 mm). If jumper is a wire, it shall have a crimped grounding lug with one hole and standard barrel for one crimp. If jumper is a flexible braid, it shall have a one- or two-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

E. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.4 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Chatsworth Products, Inc.
3. Harger Lightning and Grounding.
4. Panduit Corp.
5. Tyco Electronics Corp.
6. Or approved equal.

C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.

E. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.

F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.5 PRIMARY AND SECONDARY BONDING BUSBARS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chatsworth Products, Inc.
2. Harger Lightning and Grounding.
3. Panduit Corp.
4. Or approved equal.

B. Primary Bonding Busbar (PBB): Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4” thick by 4” high in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as PBB and shall comply with ANSI/TIA-607-D.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide a 4-inch ((100-mm)) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

C. Secondary Bonding Busbar (SBB): Predrilled rectangular bars of hard-drawn solid copper, 1/4” thick by 2” high (UON) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with ANSI/TIA-607-D.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch ((50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

2.6 LABELING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brother International Corporation.
2. Hellermann Tyton.
3. Panduit Corp.
4. or approved equal.

B. Comply with TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine the AC grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of TBC connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the TBC only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with ANSI/TIA-607-D.

D. Supplementary Grounding Electrode: Use grounding mats, where indicated, or driven ground rods. Install ground rods in suitable recessed well; fill with gravel after connection is made.

E. Provide a No. 6 AWG and ground plate to each Communications Room or board. Connect to nearest Electrical Room ground plate.

F. Provide isolated and insulated ground conductors for all microprocessor and data processing equipment.

G. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, connections are to be tightened to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

H. Provide code-sized ground cable bonding jumpers, installed with ground clamps, across all conduit expansion couplings and fittings, including flexible steel conduit used as expansion fittings.

I. Provide a corrosion-resistant finish to field connections, buried metallic bonding products, and where factory applied protective coatings have been destroyed.

J. All continuous runs of cable tray and all isolated sections of cable tray shall be bonded and grounded.

3.3 APPLICATION

A. Conductors: Install stranded conductors for No. 6 AWG and larger unless otherwise indicated.

1. The bonding conductors between the PBB/SBB and structural steel of steel-frame buildings shall not be smaller than #3/0 AWG.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, #3/0 AWG minimum.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

D. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches.

E. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch intervals.
4. Install grounding and bonding conductors in 3/4-inch PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
    a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 27 05 28 "Pathways for Communications Systems," and bond both ends of the conduit to the PBB/SBB.

3.4 GROUNDING ELECTRODE SYSTEM

A. The TBC between the PBB and the AC service equipment ground shall not be smaller than #3/0 AWG.

3.5 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 12 inches above finished floor unless otherwise indicated.

3.6 CONNECTIONS

A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than #6 AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pretwist the conductor.
3. Apply an antioxidant compound to all bolted and compression connections.

D. Primary Protector: Bond to the PBB with insulated bonding conductor.

E. Interconnections: Interconnect all SBBs with the PBB with the telecommunications backbone conductor. If more than one PBB is installed, interconnect PBBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than #3/0 AWG.

F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system

G. Exposed Shielded Cable: Bond the shield of “exposed” (i.e. outside plant copper cabling exposed to lightning or nearby power conductors) to the PBB/SBB in communications rooms and spaces with #6 AWG bonding conductor. Comply with TIA-568.1-D and TIA-568.2-D when grounding screened, balanced, twisted-pair cables.

H. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the rack bonding busbar (RBB). Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

3.7 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

1. Label PBB(s) with "fs-PBB," where "fs" is the telecommunications space identifier for the space containing the PBB.
2. Label SBB(s) with "fs-SBB," where "fs" is the telecommunications space identifier for the space containing the SBB.
3. Label the TBC and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Test the ground resistance to earth of each ground rod prior to connection to the system. Where test show resistance to ground is over 5 OHMS, report resistant values to Owner and submit test results to Owner.
3. Test the bonding connections of the system using an AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications

equipment room containing a PBB and a SBB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.

4. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.

a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the PBB and in each SBB. Maximum acceptable ac current level is 1 A.

D. Excessive Ground Resistance: If resistance to ground at the TBC exceeds 5 ohms, notify Owner and include recommendations to reduce ground resistance.

E. Grounding system will be considered defective if it does not pass tests and inspections. Correct all work that fails testing requirements and re-test system.

F. Prepare test and inspection reports.

END OF SECTION 27 05 26

SECTION 270528 – INTERIOR COMMUNICATION PATHWAYS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete interior communication pathways and to ensure that the pathways are in compliance with requirements stated or reasonably inferred by this Specifications, and the Construction Drawings.

C. This section includes minimum requirements for communication pathways for horizontal and backbone cabling.

D. This section includes minimum requirements for the following

1. Conduit
2. Sleeves
3. Fire Stop Pathways
4. Penetrations
5. Pull Boxes
6. Velcro Tie Wraps
7. Cable Hangers (J-Hooks)
8. Measuring Tape and Pull String
9. Fire Stop

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 11 00: Communications Equipment Room Fittings
3. 27 13 00: Communications Backbone Cabling
4. 27 15 00: Communications Horizontal Cabling
5. 27 51 13: Paging Systems
6. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of 27 05 00 1.4 and in particular the following code requirements

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).

2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
4. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
5. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
6. Underwriter’s Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

A. All pathways and associated equipment shall be installed in a neat and workmanlike manner. Conduit, J-hooks, cable tray and pull boxes shall be installed and properly coordinated with other trades so that they are fully accessible for installation and pulling of cable. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative.

1.5 SUBMITTALS

A. The Contractor shall provide product manufacturers data sheets for the following Items

1. Cable Tray.
2. Firestop Pathways
3. Velcro tie wraps.
4. Measuring tape / pull string.
5. Innerduct.
6. Firestop.

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

C. Shop drawings indicating the proposed layout and elevation of the following items shall be submitted for review and approval. Shop drawings shall be coordinated with the work of other trades.

1. Conduit 2” and larger.
2. Pull boxes.
3. Main J-Hook runs.
4. Sleeves.

D. As-built drawings shall be submitted at the completion of the project showing the actual routing and location of the following items:

1. Conduit 2” and larger.
2. Pull boxes.
3. Sleeves
4. Main J-Hook runs.

PART 2 – PRODUCTS

2.1 CONDUITS

A. See Electrical Specifications for additional raceway and j-box products and additional requirements.

B. Install conduit where shown on the drawings.

C. All backbone fiber and copper telecom cabling shall be installed in conduit.

D. Conduit shall be routed concealed unless otherwise noted on the drawings.

E. Install conduit for routing of horizontal telecom cabling where cable is routed through inaccessible areas including but not limited to walls, floors, chases, above gypboard or plaster ceilings, etc. Provide access doors as required to provide reasonable access for the installation of telecom cabling in inaccessible ceiling and wall spaces.

F. Install conduit for routing of horizontal telecom cabling where cabling is routed in areas subsequent to damage including mechanical and electrical rooms.

G. Install ground bushing on the ends of conduit at telecommunication rooms. Install a #6 green insulated ground conductor from the ground bushing to the grounding bar in the telecommunication room.

H. At each wall or ceiling mounted telecom outlet, the contractor shall install a 4 11/16” wide by 4 11/16” high by 2 ½” deep box with 1” conduit (UON) to an accessible ceiling space. Where the conduit stubs into an accessible ceiling space, install a plastic bushing on the end of the conduit to prevent damage to the cable jacket.

I. Where conduit penetrations are exposed in finished areas, install steel, chrome plated split ring escutcheon plates.

J. At all exterior locations or in areas subject to damage, install rigid or IMC conduit. Exposed conduit shall be painted to match existing surfaces.

1.

2.2 SLEEVES

A. Contractor shall provide sleeves as shown on the drawings and as required to route telecom cabling through floor, ceiling and wall penetrations.

B. Contractor shall provide size and quantity of sleeves so as not to exceed 20% fill ratio and to accommodate future telecom cabling.

C. Where wire cable trays penetrate fire rated walls, stop cable tray short of wall and provide 4” conduit sleeves with a UL listed firestop assembly.

D. See the Electrical Specifications for acceptable products and additional requirements.

E. Provide 4” vertical steel sleeves where shown on the drawings and to accommodate conduit or cable routing through floor slabs. Sleeves shall extend 6 inches above and below the floor slab and shall be cast into the concrete. Where sleeves are core drilled into the concrete, install firestopping material between the sleeve and the floor slab to maintain the floor rating. Provide plastic or nylon bushings on both sides of sleeves to prevent damage to cabling.

F. Provide 4” horizontal sleeves where shown at telecom rooms or rated walls to accommodate routing of horizontal cabling from the corridors. Sleeves should extend 2” beyond the wall on both sides. Provide plastic or nylon bushings on both sides of sleeves to prevent damage to cabling.

G. Install split sleeves (not shown on the drawings) to accommodate routing of horizontal cabling through non-rated full height gypboard walls. Sleeves shall be sized so as not to exceed a 20% fill rate.

H. Provide separate sleeves for routing of CAT 6 and CAT 6A cabling.

I. Install firestopping between the sleeve and structure, and between the telecom cables and the sleeve to maintain the wall rating.

J. Where sleeve penetrations are exposed in an architectural finished area, install chrome plated steel split ring escutcheon plates.

2.3 FIRE RATED PATHWAYS AT FIRE RATED WALLS

A. Provide rectangular “EZ-Path” fire rated pathways at cable penetrations through telecom room walls.

B. At each penetration location, the contractor shall provide quantity of “EZ-path” fire rated pathways to accommodate all cabling shown on the drawings. The contractor shall provide one (1) additional empty “EZ-Path” at each penetration location to accommodate future communications cabling.

C. Fire rated pathways shall have the following physical characteristics:

1. Pathways shall be UL Classified and FM approved in accordance with ASTM E814 (UL1479).
2. Pathways shall be filled with intumescent material. Intumescent material shall expand when exposed to heat and shall completely seal the pathway preventing the passage of flames and smoke.
3. Pathways shall be fastened to wall plates on each side of the wall. Multiple pathways shall be ganged with mfg gang kit.
4. The contractor shall install quantity of pathways to accommodate all telecom cables plus one additional empty pathway. Do not exceed manufacturer’s recommended fill capacity.

    a. Acceptable Products:

        (1) Specified Technologies, Inc. EZ-Path Series 44+.
        (2) No Substitutions accepted.

2.4 PULL BOXES

A. See the Electrical Specifications for additional pull box requirements and acceptable manufacturers.

B. Provide pull boxes where shown on the drawings to accommodate copper backbone cable splices.

C. Provide pull boxes in backbone cabling conduit every 100 feet and every 180 degrees of bend (whichever is the more strict provision) to facilitate pulling of backbone cabling.

D. Pull boxes shall be sized so as not to exceed the minimum bend radius of the backbone fiber and copper cabling.

E. Coordinate location of pull boxes with other trades. Provide access doors where required to access pull boxes in inaccessible wall or ceiling spaces.

2.5 CABLE HANGERS (J-HOOKS) AND SUPPORTS

A. Provide cable hangers (J-hooks) spaced at 5’-0” centers to support horizontal cable from the workstation outlet to the cable tray.

B. Hangers shall be prefabricated, zinc coated, carbon steel hangers designed specifically for 4-pair UTP communications cabling installations.

C. Hangers shall have an open top and rolled edges. Hangers shall have a minimum 2” and maximum 4” diameter loop.

D. Hangers shall be supported directly from the building structure. The Contractor shall provide anchors, beam clamps, threaded rod, rod fasteners, flange clips and brackets as needed to support the cable hangers from the building structure. Do not attach hangers to ceiling support wires or other support systems installed by other building trades.

E. J-hooks shall not support more cables than recommended by the manufacturer. J-hooks shall be sized to provide a minimum 20 percent spare capacity.

F. Cable bundles shall not exceed (24) cables and shall be loosely bound with Velcro cable straps.

G. Acceptable Products

1. Erico Caddy CableCat Clips.
2. B-Line Cable Hook System.
3. Panduit J-Pro Cable Support System.
4. Or approved equal.

2.6 VELCRO CABLE STRAPS

A. Install Velcro cable ties cut to length from a continuous roll to loosely bundle horizontal cabling routed down J-hook lines, on the cable tray and ladder rack.

B. Install Velcro cable ties at 2’-0” intervals outside of the telecom room and 1’-0” intervals inside the telecom room.

C. Do not exceed qty (24) cables per bundle.

D. Provide plenum rated Velcro tie wraps where cable is routed in plenum spaces.

E. The use of plastic tie-wraps to bundle cabling is not permitted.

A. Acceptable Products
1. Panduit HLS-15R6 or HLSP (plenum rated).
2. Leviton 43115-075.
3. Or approved equal.

2.7 MEASURING TAPE AND PULL STRING

A. Install pull string in all telecom conduit and innerduct. Pull string shall be ½” pre-lubricated high strength woven polyester with sequential foot markings. The tensile strength of the pull string shall be greater than or equal to 1,250 lbs.

B. Pull string shall meet or exceed the requirements of Bellcore GR-356-CORE “Generic Requirements for Optical Cable Innerduct and Accessories”.

C. Acceptable Products

1. Carlon TL145xx.
2. A-D Technologies Bull-Line WP12xx.
3. Or approved equal.

2.8 FIRE STOPPING

A. Provide fire stopping and backing material between sleeves/conduit penetrations through rated partitions or floors. Provide fire stopping in sleeves/conduits after all cables have been installed.

B. The minimum required fire resistance ratings of the wall of floor assembly shall be maintained by the fire stop system. The installation shall provide an air and watertight seal.

C. Fire stopping shall be listed or classified by an approved independent testing laboratory. The system shall meet the requirements of “Fire Tests of Through-Penetration Fire Stops” designated ASTM E814.

D. Manufacturer’s recommended installation standards shall be closely followed (i.e. minimum depth of material, use of ceramic fiber and installation procedures).

E. For each firestopping system on the project, submit the page from the UL fire resistance directory showing the firestopping system.

F. Acceptable Manufacturers:

1. 3M.
2. Hilti.
3. Nelson.
4. Specified Technology.
5. Or approved equal.

PART 3 – EXECUTION

3.1 COMMUNICATION PATHWAY SUPPORTS

A. All hangers for communication items (conduit, boxes, wire basket tray, j-hooks and all other related equipment) where an “Epic Deck” system occurs shall be compatible for use with this system, “Epic Deck” is by Epic Metals Corporation. See Architectural and Structural drawings for locations.

3.2 CONCEALMENT

A. Telecom cabling pathways including conduit, sleeves and cable tray shall be concealed above ceilings, in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, or in areas without ceilings, Contractor shall submit proposed routing of the raceway for review and approval prior to starting that portion of the work.

B. All telecom cabling must be routed concealed above accessible ceilings or in conduit. No exposed telecom cabling is permitted with the exception of telecom cabling routed within the telecom rooms.

3.3 COORDINATION DRAWINGS

A. The telecom drawings are diagrammatic in depicting the routing of telecom cabling pathways.

B. The contractor shall coordinate the installation of all telecom pathways with the work of other trades including Mechanical, Electrical, Plumbing, Sprinkler, Structural and Architectural.

C. The contractor shall participate in coordination meetings with other trades prior to the installation of telecom cabling pathways. For a specific space/area, the telecom contractor shall coordinate the routing of telecom pathways with all other trades that have work in that specific space/area.

D. Prior to the installation of telecom cabling pathway including conduit, basket tray, cable tray, ladder rack, sleeves, etc., the contractor shall coordinate the routing of this pathway to avoid conflicts with and provide necessary clearances from the work of other trades. The contractor shall provide all horizontal offsets, vertical offsets and radius bends as necessary to coordinate the routing of the telecom pathway with the work of other trades and building structure.

3.4 COMMUNICATION PATHWAYS

A. Prior to cable installation, the Contractor shall verify that the telecommunications pathways are installed as specified in the Drawings and Specifications. Any variations or violations from these documents shall be immediately reported to the Owner’s Representative. No portion of the Structured Cabling System shall be installed in any component of the Telecommunications Pathways and Spaces which deviates from these documents. All cabling designated on the Blueprints as terminating within a specific Telecom Room shall be installed as such unless otherwise specified in writing by the Owner’s Representative.

B. Cabling for other trades shall not occupy any pathway utilized for telecommunications cabling.

C. Where the routing of telecom pathways conflicts with the work of other trades, the telecom contractor shall reroute the telecom pathway (cable tray, conduit, sleeves, etc.) as required to eliminate the conflict.

D. The drawings are diagrammatic and provide a general routing for conduit, J-hooks and cable tray. The Contractor shall coordinate the exact routing of the communication raceway systems with other trades and the building structure. Access doors shall be installed as necessary to provide access for cable installation, inspection and maintenance.

E. Install conduit where shown on the drawings or as required to route telecom cabling in inaccessible ceiling or wall spaces. Install conduit to protect cable where routed through areas subject to damage including mechanical and electrical rooms.

F. Cable pathways including conduit, cable tray, sleeves, and J-hooks shall be sized for 20% fill capacity.

G. When installing conduit, J-hooks and cable tray, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).

1. 6” clear from power conductors.
2. 12” clear from fluorescent lighting fixtures and ballasts.
3. 36” clear from transformers and motors.

H. Provide all items necessary for the support and seismic bracing of conduit including concrete anchors, clamps, brackets, hanger rods, rod stiffeners, unistrut, splice plates, couplers, expansion joint assemblies, etc.

I. The conduit and cable tray system shall provide a continuous ground path per the National Electrical Code. Conduit and tray shall be bonded to ground at the telecom rooms. All sections of the backbone conduit and tray shall be mechanically fastened and bonding jumpers shall be installed as necessary to provide continuous ground path.

J. In order to maximize floor and wall space in the telecom rooms, all conduit must be stubbed into the room above the ladder rack UON. Conduits shall not be stubbed up through the floor slab unless specifically shown on the drawings.

3.5 SLEEVES

A. Install sleeves through walls and floors as required to route horizontal and backbone telecom cabling.

B. Provide sleeves for penetration of all gypboard walls. Layout wall penetrations as directed by the General Contractor and provide split sleeves to the framing contractor for installation.

C. Firestop all penetrations through rated walls. Firestop assemblies shall meet or exceed the rating of the walls or floors being penetrated.

D. Coordinate layout and installation of concrete wall and floor sleeves prior to concrete pours. Contractor is responsible for providing, installing, securing and covering sleeves. The contractor shall have field personnel on site during concrete pours to ensure that sleeves are not dislodged or moved during concrete pours. Contractor will be responsible for core drilling costs related to missed or improperly located sleeves.

E. Where sleeves are installed more than 24” above the overhead ladder rack in the telecom rooms, install wall mounted vertical ladder rack below the sleeves to support cabling.

F. Provide separate sleeves for routing of CAT 6 and CAT 6A cabling.

3.6 CUTTING, CORING AND PATCHING

A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the telecommunications cabling pathway system.

B. Protect existing finishes from water damage during core/cutting work and cleanup all related water and debris. Patch adjacent work disturbed by installation of new work

including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.

C. Contractor to submit all proposed concrete wall or floor penetrations to the Structural Engineer for approval prior to performing the work. Contractor shall locate and avoid cutting concrete reinforcing steel using current x-ray or pachometer equipment.

3.7 CABLE HANGERS

A. Secure cable tray and J-hook hanger supports directly to the building structure. Hangers shall not be supported from the work of other trades including ceiling supports, electrical conduits, plumbing pipes, sprinkler piping, ductwork, ceiling mounted equipment or their supports unless it is part of an engineered system.

B. Install J-hooks on a maximum of 5’-0” centers. Install J-hooks a minimum of 6” above ceiling tiles to facilitate ceiling tile removal.

END OF SECTION 270528

SECTION 270543 – EXTERIOR COMMUNICATION PATHWAYS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the exterior communication pathways and to ensure that they are in compliance with requirements stated or reasonably inferred by the Specifications and the Construction Drawings.

B. This section includes requirements for underground conduit and communication vaults as shown on the Telecom Site Plans.

C. Minimum requirements and installation methods are included for the following:

1. PVC and Rigid Conduit.
2. Precast Hand Holes and Covers 17” Wide X 30” Long.
3. Precast Pull boxes and Covers 30” Wide X 48” Long.
4. Multi-cell fabric innerduct.
5. Muletape (Pull rope).
6. Waterproofing.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 11 00: Communications Equipment Room Fittings
3. 27 13 00: Communications Backbone Cabling

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of Specification Section 27 05 00 1.4 and in particular the following code requirements:

1. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
2. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
3. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
4. ANSI/TIA-758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard (Revision B, March 2012).
5. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
6. Underwriter’s Laboratories, Inc. (UL).

1.4 SUBMITTALS

A. Manufacturer's Data Sheets: Provide data sheets for the following products:

1. PVC and Rigid Conduit.
2. Precast Hand Holes and Covers 17" Wide X 30" Long.
3. Precast Pullboxes and Covers 30" Wide X 48" Long.
4. Multi-cell fabric innerduct.
5. Muletape (Pull rope).

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

C. As-Built Drawings: Provide as-built drawings for the outside plant conduit and vaults. Drawings must be dimensioned off of building lines or curbs indicating the exact routing of the conduit and location of vaults.

PART 2 – PRODUCTS

2.1 PVC CONDUIT

A. Provide PVC conduit as shown on the Site Plan. Conduit shall be rated for direct burial, ultraviolet resistant, and conforming to UL Standard 651, NEC 347, Federal Specification W-C-1094A, Schedule 40 or Schedule 80 as specified on drawings.

B. PVC fittings shall be the same material as conduit and installed with watertight joint compound recommended by manufacturer.

C. Install pre-manufactured conduit supports and spaces spacers as required to maintain proper conduit separation between multiple conduits routed in a trench.

1. Acceptable PVC Conduit manufactured by:

a. Carlon
b. Queen City Plastics
c. Certainteed Corporation
d. Pacific Western Extruded Plastics
e. Georgia Pipe Company
f. Hubbell Incorporation
g. Cantex Incorporation
h. Triangle

2.2 RIGID METAL CONDUIT

A. Underground PVC conduit shall transition to rigid metal conduit at stub up locations through the slab on grade.

B. Conduit stub-ups in the telecom rooms shall be vinyl coated rigid steel or rigid steel wrapped with 10 mil tape.

C. Rigid metal galvanized steel conduit (RMC) shall conform to Federal Specification WW-C-581E, NEC Article 346, ANSI Standard C80.1 and U.L. Standard No. 6 for rigid metallic conduit, except hot dipped galvanized after threading.

D. Fittings, sweeps, couplings, etc., shall be galvanized threaded type meeting above standards. Threadless fittings shall not be used.

1. Acceptable RMC Manufacturers:

    a. Allied Tube and Conduit Corporation
    b. LTV Steel Tubular Productions Co.
    c. Midwest Electric-Cooper Industries
    d. Wheatland Tube Company
    e. Western Tube and Conduit Corp.
    f. Triangle Wire and Cable Inc.

2. Acceptable Bushing Manufacturers:

    a. Appleton
    b. Thomas & Betts
    c. OZ/Gedney
    d. Midwest
    e. Steel City

2.3 MULTI-CELL FABRIC INNERDUCT

A. Provide UL Listed fabric innerduct for routing of all backbone copper and fiber optic communications cabling between the MDF and all IDFs.

B. Provide qty (1) 2” 3-Cell MaxCell fabric innerduct “packs” in each 2” conduit between the MDF and the IDF’s.

C. Provide qty (2) 3” 3-Cell MaxCell fabric innerduct “packs” in each 4” conduit between the MDF and the IDF’s.

D. The MaxCell innerduct shall be terminated at the entry point of the telecom rooms and secured to the plywood backboard. 1 ¼” non-split orange corrugated innerduct shall be installed to route fiber optic backbone cabling from this point to the fiber termination cabinet(s).

E. Acceptable Products:
    1. MaxCell Edge 2” 3-Cell Part Number MXE52223xx1000 (for installation in 2” conduits) and 3” 3-Cell Part Number MXE64283xx1000 (for installation in 4” conduits).
    2. No Substitutions accepted.

2.4 MULETAPE (PULL ROPE)

A. Polyester Muletape shall be installed within each outside plant conduit and within each innerduct.

B. Mule tape shall be secured to the plywood backboard at the telecom rooms and to the unistrut racking in the pull boxes.

C. Provide 3/8” nylon mule tape with sequential foot markings and 600 lb pull strength.

D. Acceptable products:

    1. NEPTCO WP600P.
    2. Or approved equal.

2.2 TELECOM PULL BOXES (17” WIDE X 30” LONG) NON-TRAFFIC RATED

A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.

B. Provide 17” wide x 30” long x 12” deep reinforced concrete pull box.

C. Provide 17” wide x 30” long x 12” deep reinforced concrete extension.

D. Provide reinforced concrete lockable bolt down lid. Covers shall be labeled “COMMUNICATIONS”.

E. Provide additional reinforced concrete risers as required to maintain conduit depth as shown on the drawings.

F. Acceptable Products:

1. Jensen Precast HN1730-B pull box, HN1730-E extension and HN1730-L01 Lid.
2. Or Approved Equal.

2.3 TELECOM INTERCEPT PULL BOXES (30” WIDE X 48” LONG)

A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.

B. Provide 30” wide x 48” long x 30” deep reinforced concrete intercept pull box with 4” deep base.

C. Provide 30” wide x 48” long x 12” deep reinforced concrete riser.

D. Provide split incidental H-20 steel bolt down diamond plate surface. Covers shall be labeled “COMMUNICATIONS”.

E. Provide corrosion resistant galvanized steel channel racking and cable support hooks in all pull boxes. Racking and cable support hooks shall be installed on both sides of each pullbox.

F. Acceptable Products:

1. Jensen Precast PB3048-I intercept pullbox (PB3048-I), 12” Riser RS304812 and incidental H-20 Cover CA3048C61.
2. Or Approved Equal.

PART 3 – EXECUTION

3.1 UTILITY COORDINATION

A. Contact local utility companies and utility locating services prior to excavation to locate and mark existing underground utilities.

B. Coordinate conduit routing with existing underground utilities. Reroute conduit and provide horizontal and vertical offsets as required to avoid and to provide necessary clearances from existing utilities.

3.2 CONDUIT

A. OSP conduits shall be installed with a slight drain slope (0.125 inches-per-foot) away from buildings to prevent the accumulation of water in the conduit or ingress to the buildings.

B. Factory-manufactured sweeps which meet ANSI/TIA-569-B bend radius requirements shall be used for all telecommunications conduit. The bend radius of the sweeps must be a minimum of 10-times the internal conduit diameter. Bending conduit in the field using manual or mechanical methods is not acceptable.

C. Any 4" conduit with a sweep of more than 11 degrees is to have a minimum concrete encasement of 4".

D. OSP conduits shall be installed a minimum of 48” below finished grade. Conduits shall be encased in hard-tamped sand a minimum of 6” above and below the conduits. 6” clear space shall be maintained between conduits. Backfill above the conduits shall be installed and compacted to 95% density.

E. OSP conduit and duct bank runs must have a continuous orange colored, metal detectable warning tape installed half the distance between the top of the conduit and the finished grade.

F. All cable shall be installed in the lowest available conduit in a duct bank, working up as additional cables are installed.

G. Prior to installing cables, all new or unused OSP conduits must be cleaned with a brush pulled through the conduit at least two times in the same direction and swabbed with clean rags until the rag comes out of the conduit clean and dry. Conduits shall then be tested with a mandrel to prove compliance with the sweep radius requirements throughout the conduit run.

H. Spare OSP conduits and innerducts shall be plugged with watertight plugs at both ends to prevent the intrusion of moisture, gasses, and rodents throughout the construction project.

I. All OSP conduits and innerduct shall have a 3/8” nylon pull rope installed. Pull rope shall be re-pulled each time an additional cable is installed.

3.3 PULL BOXES

A. Install pull boxes and set covers to match finished grade.

B. Conduits shall enter pull boxes from the side. Do not sweep conduits into the bottom of the pull box.

3.4 CUTTING AND PATCHING

A. Sawcut and remove existing pavement, sidewalks, gutters, etc., to accommodate installation of outside plant conduit and pull boxes.

B. Replace sub-base, pavement, sidewalks gutters, etc., to match existing.

C. Repair and replace all landscaping and sitework disturbed by excavation including but not limited to irrigation lines, lawns, planting, etc. Resod lawn areas disturbed by excavation.

END OF SECTION 270543

SECTION 270800 – COMMISSIONING OF COMMUNICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the testing, labeling and documentation of the telecom cabling system in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

C. This section includes the minimum requirements for the testing, identification and administration for the telecommunications cabling system, including the following:

1. Testing

    a. Category 6 Cable Test Equipment and Test Procedures.
    b. Category 6A Cable Test Equipment and Test Procedures.
    c. Copper backbone cable test equipment and test procedures.
    d. Fiber optic cable test equipment and test procedures.
    e. Cable test reports.

2. Identification

    a. Labeling of work area outlet faceplates and jacks.
    b. Labeling of horizontal data, voice and video cabling.
    c. Labeling of Copper Patch Panels.
    d. Labeling of fiber optic patch panels.
    e. Labeling of 110 wiring blocks.
    f. Labeling of racks and cabinets.
    g. Labeling of copper and fiber backbone cable.
    h. Labeling of innerduct.

3. Administration

    a. As-built drawings.
    b. Materials listing.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 11 00: Communications Equipment Room Fittings
3. 27 13 00: Communications Backbone Cabling
4. 27 15 00: Communications Horizontal Cabling
5. 27 51 13: Paging Systems

6. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of Specification Section 27 05 00 1.4 and in particular the following requirements

1. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
2. ANSI/TIA-568.3-D: Optical Fiber Cabling and Component Standard (Revision D, October 2016).
3. ANSI/TIA-598-D: Optical Fiber Cable Color Coding (Revision D, July 2014).
4. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
5. ANSI TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (Revision A, July 2015).
6. ANSI/TIA-526-14-C: Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant (Revision C, 2015).
7. ANSI/TIA-1152-A: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling (Revision A, November 2016).
8. ANSI/NFPA-70, 2023 -- National Electrical Code (NEC).
9. Underwriter’s Laboratories, Inc. (UL).

1.4 SUBMITTALS

A. Test Equipment: Submit manufacturers’ catalog sheets and specifications for the following cable testers

1. Category 6 cable tester.
2. Category 6A cable tester.
3. Category 3 backbone copper cable tester.
4. Multimode and/or singlemode fiber optic cable tester.

B. Calibration Reports: Provide calibration reports for all test equipment to be used on the Project. The calibration must have been performed by a manufacturer certified calibration facility and be dated no more than 60 days prior to the start of testing.

C. Cable Test Reports: Provide bound test reports for all cables signed by the technician performing the cable testing. Include Manufacturers data sheets for the cabling being tested.

D. Labels: Submit manufacturer’s data sheets on the type of labels to be used for each labeling application.

PART 2 – PRODUCTS

2.1 HORIZONTAL CATEGORY 6 UNSHIELDED TWISTED-PAIR CABLE TESTER

A. Shall perform all tests necessary to certify the horizontal Category 6 UTP cabling in accordance with ANSI/TIA/EIA 568 B.2-1.

B. Shall be a UL certified Level III test set calibrated by a manufacturer certified calibration facility. The calibration shall be dated no more than 60 days prior to the start of testing.

C. Acceptable Manufacturers

1. Fluke Networks
2. Ideal Industries
3. Agilent Technologies
4. Or equal.

2.2 CATEGORY 6A (AUGMENTED) UNSHIELDED TWISTED-PAIR CABLE TESTER

A. Shall perform all tests necessary to certify the horizontal Category 6A UTP cabling in accordance with ANSI/TIA/EIA 568 B.2-1 and Category 6A standard ANSI/TIA/EIA–568-B.2-10 -- Augmented Category 6 Cable.

B. Shall be a UL certified Level IV test set calibrated by a manufacturer certified calibration facility. The calibration shall be dated no more than 60 days prior to the start of testing.

C. Acceptable Manufacturers

1. Fluke Networks
2. Ideal Industries
3. Agilent Technologies
4. Or equal.

2.3 OPTICAL FIBER CABLE TESTERS

A. The Contractor shall test all strands of optical fiber cable with an approved power meter and light source. OTDR Trace results to be provided on all fiber strands.

B. The tester shall be capable of performing the tests required by ANSI/TIA/EIA – 568-B.1, ANSI/TIA/EIA–526-14A, and ANSI/TIA/EIA–526-7.

C. The tester shall have been calibrated by a manufacturer certified calibration facility. The calibration shall be dated no more than 60 days prior to the start of testing.

D. Acceptable Manufacturers

1. Fluke Networks
2. Ideal Industries
3. Agilent Technologies
4. Or equal.

2.4 LABELS

A. Labels shall be laser printed and shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Acceptable manufacturers

1. Belden
2. Brady
3. Brother
4. HellermannTyton.

5. Or approved equal

2.5 WORK AREA OUTLET FACEPLATE LABELS

A. Label each port in each faceplate in accordance with Labeling Scheme identified on the Drawings. Label must be machine printed and inserted in the faceplate label window. Labels shall be provided by the faceplate manufacturer of the faceplate.

B. Acceptable manufacturers

1. Belden
2. Brother
3. HellermannTyton.
4. No Substitution

2.6 HORIZONTAL CABLE SHEATH LABELS

A. Label horizontal cable sheaths at work area outlets and at patch panels with laser printed self-laminating wrap around vinyl labels. Labels shall be in accordance with the Labeling Scheme identified in WCSD SCS-015.

B. Labels shall be white with black type. Label size shall be 1.0” wide by 1.5” high.

C. At the Telecom Room, cable labels will be affixed to cable a minimum of 1 inch from the termination on the patch panel, and placed in such a way as to be clearly visible.

D. At the work area outlet, cable labels shall be affixed to the cable 2 inches from the termination on the jack.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

2.7 COPPER PATCH PANEL LABELS.

A. Label each patch panel with a single panel ID label in accordance with the labeling scheme identified WCSD SCS-015.

B. Labels shall be compatible with the patch panels provided for the Project.

C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5” wide by 0.5” high.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

D. Label each patch panel port with a laser printed label. Label each port with the room number of the room housing the work area outlet.

E. Labels shall be compatible with the patch panels provided for the Project.

F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.375” high.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

2.8 TELECOM ROOM FIBER OPTIC TERMINATION CABINET LABELS

A. Label each fiber optic patch panel with a single panel ID label in accordance with the labeling scheme identified WCSD SCS-015.

B. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5” wide by 0.5” high.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

C. A label will be affixed to the fiber termination cabinet as shown using the Backbone Cable Labeling Scheme.

D. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5” high.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

2.9 EQUIPMENT ROOM FIBER OPTIC TERMINATION CABINET LABELS

A. Label each fiber termination cabinets in accordance with the labeling scheme identified in WCSD-SCS-015.

B. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5” wide by 0.5” high.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

C. Label fiber modules in accordance with the labeling scheme identified in WCSD-SCS-015. Labels shall be affixed to the fiber termination cabinet directly on the Plexiglas front cover so labels will be visible when the cover is closed. Each label will indicate the exact location and position of the cable's far end according to the Backbone Cable Labeling Scheme.

D. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" high.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

E. Label each Connector Module with its Slot in accordance with the labeling scheme identified on the drawings.

F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

2.10 EQUIPMENT RACK LABELS

A. Provide labels on the top angle of all equipment racks. Labels shall in accordance with the labeling scheme identified in WCSD-SCS-015.

B. Racks shall be labeled with Space ID and Rack ID.

C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 1.0" high.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

2.11 COPPER BACKBONE CABLE SHEATH LABELS

A. The backbone cable sheaths in the Telecom rooms and at pull boxes shall be labeled. Labels shall be in accordance with the labeling scheme identified in WCSD-SCS-015.

B. Labels must be clearly visible at the rear of the rack.

C. Labels shall be self-laminating vinyl labels and must be compatible with the diameter of the backbone cable. Labels shall be 2.5” high by 1.5” wide.

1. Acceptable Manufacturers:

a. Belden
b. Brady
c. Brother
d. HellermannTyton.
e. Or approved equal

PART 3 – EXECUTION

3.1 CABLE TESTING – GENERAL

A. Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.

B. Where post-manufacture test data has been provided by the manufacturer on the reel or shipping carton, submit copies to the Owner's Representative as part of the cable test results.

C. The Owner's Representative reserves the right to observe any or all portions of the cable testing process.

D. The Owner's Representative further reserves the right to conduct, using contractors equipment and labor, a random re-test of up to ten percent (10%) of the cable plant to confirm documented test results.

E. Test results and corrective procedures are to be documented and submitted to the Owner's Representative within five (5) working days of test completion.

3.2 CATEGORY 6 UTP CABLE TESTING

A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

B. Field test measurements shall be made in accordance with Annex I of ANSI/TIA/EIA-568-B.2 unless otherwise noted.

C. Field test measurements shall be conducted from 1 MHz to 250 MHz.

D. Field testing shall be conducted using a level III tester. The accuracy of the level III tester shall meet or exceed the requirements of Annex B of ANSI/TIA/EIA-568-B.2-1. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

E. Every cabling link shall be tested in accordance with the ANSI/TIA/EIA-568-B.1 Section 11.2: “100-Ohm twisted-pair transmission performance and field test requirements”.

F. The installed twisted-pair horizontal links shall be tested from the patch panel in the telecommunications room to the work area outlet. The cable must pass the “Permanent Link” performance limits specification as defined in ANSI/TIA/EIA-568-B.1.

G. 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned above. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

H. Trained technicians who have successfully attended an appropriate training program shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

I. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-B; Annex I: Section I.2.2).

J. The Contractor shall provide Category 6, 250 MHz channel test results on all pairs of cable. The following minimum field test parameters are required:

1. Wire map (including cable shield if present).
2. Length.
3. Insertion loss.
4. Near-end crosstalk (NEXT) loss.
5. Power sum near-end crosstalk (PSNEXT) loss.
6. Equal-level far-end crosstalk (ELFEXT).
7. Power-sum equal-level far-end crosstalk (PSELFEXT).
8. Return loss.
9. Propagation delay.
10. Delay skew.

K. Test results shall be provided in electronic format and printed 8.5” x 11” format signed by the technician performing the testing. The electronic format should be a Microsoft Word .doc file. Along with the above test parameters, the following information must be included for each cable tested:

1. Name of Owner and name of project (building name).
2. Date and time of test.
3. Name of technician performing the field testing.
4. Manufacturer, model number, serial number and software revision of field tester.
5. Cable ID (Telecom Room # - Patch Panel # - Port # / Work Area Room # - Telecom Outlet – Jack #).
6. Overall Pass/Fail result.
7. Manufacturer, category and model number of cable.
8. NVP used to determine cable length.

3.3 CATEGORY 6A (AUGMENTED) UTP CABLE TESTING

A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

B. Field test measurements shall be made in accordance with Annex I of ANSI/TIA/EIA-568-B.2 1 and the Category 6A standard ANSI/TIA/EIA–568-B.2-10.

C. Field test measurements shall be conducted from 1 MHz to 500 MHz.

D. Field testing shall be conducted using a level IV tester. The accuracy of the level IV tester shall meet or exceed the requirements of Annex B of ANSI/TIA/EIA-568-B.2-1 and the Category 6A standard ANSI/TIA/EIA–568-B.2-10. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

E. Every cabling link shall be tested in accordance with the ANSI/TIA/EIA-568-B.1 Section 11.2: “100-Ohm twisted-pair transmission performance and field test requirements”.

F. The installed twisted-pair horizontal links shall be tested from the patch panel in the telecommunications room to the work area outlet. The cable must pass the “Channel” performance limits specification as defined in ANSI/TIA/EIA-568-B.1.

G. 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned above. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

H. Trained technicians who have successfully attended an appropriate training program shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

I. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-B; Annex I: Section I.2.2).

J. The Contractor shall provide Category 6A, 500 MHz channel test results on all pairs of cable. The following minimum field test parameters are required:

1. Wire map (including cable shield if present).
2. Length.
3. Insertion loss.
4. Near-end crosstalk (NEXT) loss.
5. Power sum near-end crosstalk (PSNEXT) loss.
6. Equal-level far-end crosstalk (ELFEXT).
7. Power-sum equal-level far-end crosstalk (PSELFEXT).
8. Return loss.
9. Propagation delay.
10. Delay skew.

K. Testing and certification of the Category 6A cabling system for Alien Crosstalk IS REQUIRED as follows:

The Contractor shall perform Alien Crosstalk testing on 1% of the installed CAT 6A links. Testing shall be performed in accordance with Fluke Electronic's or Agilent Technologies' current White Paper specifying field Alien Crosstalk testing procedures. "Worst case" CAT 6A links shall be selected for the testing based on overall cable length and where the cable is routed adjacent to the largest number of cables.

L. Test results shall be provided in a CD-ROM format within 5 days after the completion of the project. Test documentation shall be saved in Fluke LinkWare file format version 2.2 or later and must include (along with the above test parameters), the following information:

1. Test results as downloaded from the tester. The following information shall be included in the test results:

    a. Record of test frequencies.
    b. Cable type.
    c. Conductor pair and cable I.D.
    d. Measurement direction.
    e. Reference setup.
    f. Crew member name(s).

2. Additional documentation required to provide the following (if not included in test results):

    a. Test equipment name, manufacturer, model number, serial number, software version and last calibration date.
    b. The test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
    c. Any required information not listed in test results (crew member, etc.).

3. The CD shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year).

4. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The Contractor must provide a copy of the last calibration certification with submitted test results.

5. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

3.4 BACKBONE UTP COPPER CABLE TESTING

A. 100% of the backbone copper cable pairs shall be tested for opens, short, polarity reversals, transpositions, and the presence of AC voltage.

B. The Contractor shall examine open and shorted pairs to determine if the termination has been done properly. If so, the Contractor shall tag bad pairs at both ends and make note on the as-built documentation.

C. If copper backbone cable contains more than two percent (2%) bad pairs, the Contractor shall remove and replace the cable at the Contractor's expense.

D. The Contractor shall test all backbone copper cables and submit test result information in an electronic format and a printed 8.5” x 11” format signed by the technician performing the testing. The electronic format should be a Microsoft Word .doc file.

3.5 OPTICAL FIBER CABLE TESTING

A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

B. 100% of the installed cabling links must be tested and must pass the field test specifications defined by the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-B.1, ANSI/TIA/EIA-568-B.3 and ANSI/TIE/EIA-568-C.0. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

C. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

1. The manufacturer of the fiber optic cable and/or the fiber optic connectors.
2. The manufacturer of the test equipment used for the field certification tests.
3. Training organizations authorized by BICSI or by the ACP (Association of Cabling Professionals™) Cabling Business Institute.

D. Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-B.1) with a Category 1 light source. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

E. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

F. The fiber optic launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

G. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

H. Performance Test Parameters:

1. The multimode backbone links shall be tested in one direction at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A.
2. Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper or equivalent method.
3. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-C.

Link Attenuation = Cable Attenuation + Connector Insertion Loss + Splice Insertion Loss

Where:

Cable Attenuation(dB) = Attenuation Coefficient(dB/Km) x Length(km)

Connector Insertion Loss(dB) = # of connector pairs x connector loss(dB)

Splice Insertion loss(dB) = # of splices(S) x splice loss(dB)

The values for the Attenuation Coefficient are listed in the following table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation Coefficient (dB/km)
Multimode 50/125 um	850	3.5
Multimode 50/125 um	1300	1.5
Single Mode	1310	0.5
Single Mode	1550	0.5

4. The maximum allowable connector insertion loss = 0.75 dB. The maximum allowable splice loss = 0.3 dB.

I. The Contractor shall test all fiber optic cables and provide test results in electronic format and printed 8.5” x 11” format signed by the technician performing the testing. The electronic format should be a Microsoft Word .doc file. The following field test documentation shall be provided for each fiber optic strand:

1. Wavelength of test (850 nm or 1300 nm for Multimode and 1310 nm or 1550 nm for Singlemode)
2. Length of segment.
3. Number of splices.
4. Link attenuation (for each wavelength).
5. Overall Pass/Fail result.
6. Margin by which the strand passed the test (difference between the allowable link attenuation and the measured link attenuation).
7. Name of Owner and name of project (building name).
8. Date and time of test.
9. Name of technician performing the field testing.
10. Manufacturer, model number, serial number and software revision of field tester.
11. Cable ID (Telecom Room # - Patch Panel # - Port # / Telecom Room # - Patch Panel # - Port #.Telecom Outlet – Jack #).
12. Manufacturer, model number of cable, type of cable and strand count.

3.6 CABLE TESTING VALIDATION

A. If requested by the Owner’s Representative, the Contractor shall participate in cable testing validation.

B. After the Contractor has completed all cable testing and submitted test results, the Contractor shall, in the presence of the Owner's Representative, test up to 5% of the installed and tested cables (random sample to be selected by the Owner's Representative).

3.7 IDENTIFICATION AND LABELING

A. The Contractor shall confirm the telecom room and work area room numbers with the Owner or Owner's Representative prior to labeling.

B. Labeling scheme shall follow the requirements of Washoe County School District Structured Cabling Specification WCSD-SCS-015 dated March 13, 2023.

C. Work Area Outlet Face Plates: See WCSD-SCS-015 for requirements.

D. Work Area Data and Voice Jacks: See WCSD-SCS-015 for requirements.

E. Work Area Horizontal Data, Voice and Video Cable: See WCSD-SCS-015 for requirements.

F. Telecom Room Horizontal Data, Voice and Video Cable: See WCSD-SCS-015 for requirements.

G. Patch Panels: See WCSD-SCS-015 for requirements.

H. Patch Panel Ports: See WCSD-SCS-015 for requirements.

I. Fiber Termination Cabinets: See WCSD-SCS-015 for requirements.

J. 110 Blocks: See WCSD-SCS-015 for requirements.

K. Backbone Cables: See WCSD-SCS-015 for requirements.

L. Equipment Racks and Cabinets: See WCSD-SCS-015 for requirements.

3.8 ADMINISTRATION

A. As-Built Drawings.

1. The Contractor shall provide As-Built drawings at the end of the project. One (1) reproducible and (1) blue line shall be provided. Electronic versions of the drawings in AutoCAD version 2000/2002 and PDF shall also be provided. The following information shall be provided on the As-Built Drawings:

   a. Plan location of all telecom outlets.
   b. Quantity and type of drops at each telecom outlet.
   c. Telecom room where the drops are terminated.
   d. Cable tray layout. Provide dimensions from building grid lines to locate cable tray.
   e. J-hook layout. Provide dimensions from building grid lines to locate J-hook runs.
   f. Conduits and pull box layout. Provide dimensions from building grid lines to locate conduits and pull boxes.
   g. Backbone cable runs and pair/strand counts.
   h. Horizontal and vertical sleeve layout.
   i. Outside plant vaults and pull boxes. Provide dimensions from curbs to locate vaults and pull boxes.
   j. Outside plant conduits. Provide dimensions from curbs to locate conduit.

B. Materials Listing

1. The contractor shall provide a spreadsheet indicating the materials and quantities used on the project. At a minimum, the spreadsheet will contain the following

information: Item description, manufacturer, part number, quantity and color (where applicable).

END OF SECTION 270800

SECTION 271100 – COMMUNICATION EQUIPMENT ROOM FITTINGS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete communication equipment rooms and spaces, and to ensure that they are in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

C. Minimum requirements and installation methods are included for the following:

1. 4-Post Equipment Racks (45 RU)
2. Concrete Expansion Anchors
3. Plywood Backboards
4. Horizontal Cable Managers
5. Vertical Cable Managers for Floor Standing Racks
6. Category 5E Copper Patch Panels
7. Category 6 Copper Patch Panels
8. Category 6 Copper Patch Cords
9. Category 6A Copper Patch Panels
10. Category 6A (Augmented) Copper Patch Cords
11. Rack Mounted Optical Fiber Termination Cabinets
12. Optical Fiber Patch Cords
13. Wall Mounted “Re-closeable” Fiber Optic Cable Storage Rings
14. Cable Runway (Ladder Rack)
15. Velcro Cable Ties
16. Grounding Bars and Ground Conductors

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 05 43: Exterior Communications Pathways
4. 27 08 00: Commissioning of Communications
5. 27 13 00: Communications Backbone Cabling
6. 27 15 00: Communications Horizontal Cabling
7. 27 51 13: Paging Systems
8. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of Specification Section 27 05 00 1.4 and in particular the following standards and code requirements.

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
4. ANSI/TIA-568.3-D: Optical Fiber Cabling and Component Standard (Revision D, October 2016).
5. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
6. ANSI/TIA-598-D: Optical Fiber Cable Color Coding (Revision D, July 2014).
7. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
8. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
9. ANSI/NFPA-70, 2023 - National Electrical Code (NEC).
10. Underwriter’s Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

A. All cable, raceways and equipment in the telecom rooms shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative.

1.5 SUBMITTALS

A. Manufacturer’s Data Sheets: Submit manufacturer’s data sheets in electronic PDF format for the following items:

1. 4-Post Equipment Racks (45 RU)
2. Concrete Expansion Anchors
3. Plywood Backboards
4. Horizontal Cable Managers
5. Vertical Cable Managers for Floor Standing Racks
6. Category 5E Copper Patch Panels
7. Category 6 Copper Patch Panels
8. Category 6 Copper Patch Cords
9. Category 6A Copper Patch Panels
10. Category 6A (Augmented) Copper Patch Cords
11. Category 6 Entrance Terminals with Primary Protector Modules
12. Rack Mounted Optical Fiber Termination Cabinets
13. Optical Fiber Patch Cords
14. Wall Mounted “Re-closeable” Fiber Optic Cable Storage Rings
15. Cable Runway (Ladder Rack)
16. Velcro Cable Ties
17. Grounding Bars and Ground Conductors

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

C. Shop Drawings: Submit shop drawings indicating the proposed layout of all telecom cabling pathways and equipment located in the telecommunication rooms, including

coordinated rack elevations for existing and new rack-mounted equipment shown on the Contract Drawings. Shop drawings shall be coordinated with all trades having work in the telecom rooms. Shop drawings shall include the following items:

1. Plan view showing the layout of all floor mounted telecom and electrical equipment including cabinets, racks, UPS's and vertical cable management devices. Dimensions shall be provided showing required maintenance clearances in the front, rear and side of all equipment.
2. Plan view of all vertical floor sleeves and floor openings.
3. Plan view showing the layout of all cable pathway including horizontal ladder rack, horizontal basket tray, cable radius drop outs, vertical ladder rack and sleeves.
4. Plan view showing the location of all lighting fixtures, HVAC ductwork, fan coil units and/or split units serving the room. The contractor shall coordinate this work so that it does not conflict with the overhead cabling pathways or other telecom equipment.
5. Plan view showing the layout of all wall mounted equipment including ground bars, wall mounted racks, building entrance terminals, wall mounted termination fields, security panels, electrical panels, etc.
6. Wall elevations showing the layout and elevation of all wall mounted equipment.

1.6 DELIVERY, STORAGE & HANDLING

A. Protect all wiring blocks, patch panels, jacks and patch cords from moisture, dust and debris prior to installation.

B. Install equipment in the telecom rooms only after the room construction is complete and the room clean. This includes all gypboard walls, gypboard ceilings, floor finishes, t-bar grid, plywood backboards, door frames, doors and paint. Notify the Owner's Representative of any incomplete items prior to installing equipment.

1.7 GUARANTEE

A. See Specification Section 270500 1.10 for warranty requirements which apply to the patch panels and cabling specified in this section.

PART 2 – PRODUCTS

2.1 4-POST OPEN EQUIPMENT RACKS (45 RU)

A. Floor mounted racks shall meet the following physical specifications

1. UL Listed.
2. Lightweight aluminum construction with black finish.
3. 19" rack mounting space, 84" high.
4. 15" deep x 20.25" wide base with four (4) ¾" bolt down holes.
5. 3" deep channel side rails with double-sided tapped holes. Tapped holes shall conform to the standard EIA/TIA hole pattern.
6. Provide square-punched hardware kits (cage nuts – color black) to mount all hardware and owner furnished equipment.
7. Provide 50 Phillips head equipment mounting screws with each rack.
8. Provide a ground termination bracket with each rack to enable connection of a 2 hole grounding lug.

B. Acceptable Products

1. Chatsworth Quadrarack 4-Post Rack 15053-703.
2. No Substitutions.

C. Provide base dust cover for each rack:

1. Acceptable Products:

a. Chatsworth p/n 16341-719.
b. No Substitutions.

D. Provide rack grounding kit with each rack:

1. Acceptable Products:

a. Rack Grounding Kit (Chatsworth p/n 40167-001).
b. No Substitutions.

E. Provide Square-Punched Hardware Kits with each rack.

1. Acceptable Products:

a. Chatsworth p/n 12639-001.
b. No Substitutions.

F. Provide 1RU blank filler panels where shown on the rack elevations.

1. Acceptable Products:

a. Chatsworth p/n 30024-701.
b. No Substitutions.

G. Provide 4RU lock boxes where shown on the rack elevations.

1. Acceptable Products:

a. Middle Atlantic P/N LBX-4
b. No Substitutions.

2.2 CONCRETE EXPANSION ANCHORS

A. Secure equipment racks and cabinets to the concrete floor with a minimum of four (4) 1/2” diameter concrete expansion anchors. Expansion anchors shall be manufactured of carbon steel with zinc plating.

B. Anchors shall have a minimum concrete embedment depth of 2 ¾” inches.

C. Expansion anchors shall have a minimum allowable pull out strength of 1,800 lbs and a minimum ultimate pull out strength of 7,000 lbs in 3,000 psi concrete.

1. Acceptable manufacturers

a. Hilti.
b. Red Head.
c. Or approved equal.

2.3 PLYWOOD BACKBOARDS

A. Install fire treated 4’-0” x 8’-0” x ¾” AC void free plywood in all telecom rooms.

B. Install plywood to completely cover all 4 walls in each telecom room unless noted otherwise on the drawings.

C. Install plywood sheets from 6” to 8’-6” AFF.

D. Paint plywood with 2 coats of white paint. Mask fire treatment labels prior to painting.

E. Secure plywood to walls with sufficient anchors to support 1,500 lbs of equipment weight.

2.4 HORIZONTAL CABLE MANAGEMENT

A. Horizontal and vertical cable managers shall be provided from the same manufacturer and shall be compatible with the specified racks.

B. Horizontal cable managers shall be 2 rack units in height and have. See rack elevations for quantity.

C. All components shall be color black.

1. Acceptable Products:

a. Chatsworth P/N 11564-719 with slip on cover P/N 11764-719.
b. No Substitutions.

2.5 VERTICAL CABLE MANAGEMENT FOR FLOOR STANDING RACKS

A. Horizontal and vertical cable managers shall be provided from the same manufacturer and shall be compatible with the specified racks.

B. Provide 6” wide by 84” high or 10” wide x 84” high vertical cable managers for all racks. See rack elevations for size and quantity:

1. Vertical cable managers shall be bolted to the racks. Where vertical cable managers are located between racks, the vertical managers shall be bolted to both racks.

2. Each vertical cable manager shall provide separate front and rear raceways.

3. Holes shall be provided between the front and rear raceway sections to facilitate cable routing.

4. Vertical cable managers shall have 6” wide x 5.35” deep slotted ducts on the front of the rack and open ring cabling sections on the rear of the rack.

5. Hinged black plastic covers shall be provided on the front of the vertical cable manager to conceal cable after installation.

6. All components shall be color black.

7. Acceptable Products

a. Chatsworth CCS Combination Cabling Section p/n 30162-703 (6” wide), Chatsworth CCS Combination Cabling Section p/n 30163-703 (10” wide)
b. No Substitutions.

C. Provide (12) fiber management spools within the vertical cable management sections installed on each side of the main fiber rack in the MDF room (6 spools in each vertical section). Attach spools to the 2.5” pass-through holes in the CCS combination cabling section. The top 6 pass-through holes shall be used, leaving the bottom pass-through hole empty.

2.6 CATEGORY 5E COPPER PATCH PANELS

A. Provide 19” rack mounted 48-port or 24-port Category 5E data patch panels as shown on the drawings.

B. Patch panels shall be constructed of black anodized aluminum or black powder coated steel.

C. Patch panels shall have fixed outlet jacks with 110 IDC connectors on the rear of the panel.

D. Patch panels shall be wired in accordance with the T568B standard.

E. The same manufacturer will be used for both the patch panels and workstation outlets throughout the Project.

F. Provide rear cable termination bracket with each patch panel.

G. Patch panels shall conform to ANSI/TIA/EIA–568-A Addendum 5 as shown below.

Parameter	Worst Case Channel Performance at 100MHz
Specified Frequency Range	1-100 MHz
Attenuation	0.4 dB
NEXT	43.0 dB
Return Loss	20.0 dB

H. Acceptable Products:

1. Belden/CDT P/N AX103258 (24-port), AX103259 (48-port). Provide cable tie-bar for each patch panel AX101173.
2. No Substitutions.

2.7 CATEGORY 5E COPPER PATCH CORDS FOR BACKBONE VOICE CABLING.

A. For every installed 25-pair CAT 5E backbone cable, provide qty (4) 7'-0" Category 5E patch cords with blue jackets

B. Acceptable Products:

1. Belden/CDT P/N C501106007.
2. No Substitutions.

2.8 CATEGORY 6A (AUGMENTED) COPPER DATA PATCH PANELS

A. Patch Panels shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Provide 19” rack mounted 48-port Category 6A data patch panels as shown on the drawings. Category 6 field device cabling for surveillance, audio enhancement, and paging systems shall terminate on Category 6A RevConnect patch panels where indicated in the cable and termination schedule.

C. Patch Panels shall be 100% pre-loaded with CAT 6A modules.

D. Each patch panel CAT 6A module shall be provided with a color coded icon insert to designate its relationship to the following systems:

1. Data Port: Icon Insert – No icon insert required.
2. Wireless Access Point Port: Icon Insert color “White”.
3. CCTV System: Icon insert color “Black”.
4. Audio Enhancement System: Icon insert color “Gray”.
5. Paging System: Icon insert color “Green”.

E. Patch panels shall conform to the performance requirements of ANSI/TIA/EIA–568-B.2-10 for Augmented Category 6 Cable as outlined below.

Frequency (MHz)	NEXT (dB) (min.)	PSANEXT (dB) (min.)	RETURN LOSS (dB) (min.)
0.772	96.2	112.2	70.2
1	94.0	110.0	68
4	82.0	98.0	56
8	75.9	91.9	49.9
10	74.0	90.0	48.0
16	69.9	85.9	43.9
20	68.0	84.0	42.0
25	66.0	82.0	40.0
31.25	64.1	80.1	38.1
62.5	58.1	74.1	32.1
100	54.0	70.0	28.0
200	48.0	64.0	22.0
250	46.0	62.0	20.0
300	44.5	60.5	18.5
350	43.1	59.1	17.1
400	42.0	58.0	16.0
450	40.9	56.9	114.9
500	40.0	56.0	14.0
550	39.2	55.2	13.2
600	38.4	54.4	12.4
625	38.1	54.1	12.1

F. Acceptable Products:

1. 48-Port Cat 6A Patch Panels:

a. Belden/CDT RevConnect P/N RVAPPF2U48BK.
b. No Substitutions.

2. Colored Icon Inserts:

a. Belden/CDT RevConnect P/N RVUICxx-B24 (provide icon insert colors for different systems as indicated above).
b. No Substitutions.

2.9 CATEGORY 6 COPPER PATCH CORDS

A. Patch cords shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Provide Category 6 UTP patch cords for interconnection of owner furnished switches and patch panels in all IDF's and the MDF.

1. Provide one (1) 4'-0" CAT 6 patch cord for each data drop or device connection related to the following systems, coordinated with the cable and termination schedule and system diagrams:
2.
3. CCTV System: Patch Cord Color "Black".
4. Audio Enhancement System: Patch Cord Color "Gray".
5. Paging System: Patch Cord Color "Green".

C. Cabling used for patch cords shall be manufactured by the same manufacturer as the horizontal cabling and shall be of the same product line. Cable shall conform to the requirements of ANSI/TIA/EIA–568-B.2 Addendum 1. Electrical characteristics and performance of the patch cables shall be nearly identical to the horizontal cable with exceptions given due to differences between solid and stranded conductors as indicated in the following table.

Frequency (MHz)	Stranded Conductor Cable Insertion Loss (dB)
1	2.4
4	4.5
8	6.4
10	7.1
16	9.1
20	10.2
25	11.4
31.25	12.8
62.5	18.5
100	23.8
200	34.8
250	39.4

D. Patch cords shall be rated for use as communications cable and shall have the designation "CM" or "CMR" printed on the jacket.

E. Acceptable Products:

1. Belden/CDT GigaFlex PS6+ Modular Cord P/N C60110xxxx (provide patch cord jacket colors for different systems as indicated above).
2. No Substitutions.

2.10 CATEGORY 6A (AUGMENTED) PATCH CORDS

A. Patch cords shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Provide Category 6A patch cords for interconnection of owner furnished switches and patch panels in all IDF's and the MDF. Provide one (1) 4'-0" CAT 6A patch cord for each data drop related to the following systems:

1. Telecom Outlet: Patch Cord Color "Yellow".
2. Wireless Access Point: Patch Cord Color "White".

C. Provide Category 6A "work-area" patch cords for interconnection of owner furnished workstations and phones at the work-area outlets. Provide one (1) 15'-0" CAT 6A patch cord for each data drop related to the following systems:

3. Telecom Outlet: Work-Area" Patch Cord Color "Yellow".

D. Patch cords shall be 4-pair, Category 6A unshielded twisted pair with solid conductors. Patch cords shall be manufactured by the same manufacturer of the horizontal cabling.

E. Physical Characteristics:

1. Category 6A cable shall meet or exceed the requirements of ANSI/TIA/EIA–568-B.2-10 -- for Augmented Category 6 Cable.

2. Cable shall have a listed riser rated jacket (CMR).

3. Cables shall be constructed of 4-pair, 23 AWG solid copper conductors.

4. The cable jacket must have the following legible markings

a. Manufacturer's name.
b. Copper conductor gauge.
c. Pair count.
d. UL and CSA listing.
e. Manufacturer's trademark.
f. Category rating.
g. Jacket rating (CMR).

F. Acceptable Products:

1. Belden/CDT CA21104004 (4'-0" data drop patch cord - color yellow), CA21109004 (4'-0" WAP drop patch cord - color white), CA21104015 (15'-0" data drop "work-area" patch cord – color yellow).
2. No substitutions.

2.11 WALL MOUNTED CATEGORY 5E 110 BLOCKS

A. Provide 100-pair Category 5E wall mounted 110 IDC blocks with plastic stand-off mounting legs for termination of voice cabling from the AT&T demarc location to the 24-port demarc patch panel in the voice rack (see drawings for location).

B. Provide label kit w/plastic holders.

C. Provide plastic jumper troughs with stand-off legs at the top, bottom and side of each 100-pair wiring block for routing of cross connect wire.

D. Completely load 110 blocks with C5 connecting blocks.

E. Acceptable Products

1. Belden/CDT AX100694-S.
2. Or approved equal.

2.12 RACK MOUNTED OPTICAL FIBER TERMINATION CABINETS & PIGTAIL SPLICE CASSETTES

A. Provide 19” rack mounted optical fiber termination cabinets. See rack elevations for quantity, size and port density of panels.

B. Provide fiber termination cabinets with the following physical characteristics:
1. 2RU (accepts 8 pigtail splice cassettes) and 4RU (accepts 16 pigtail splice cassettes).
2. Black powder coat finish.
3. Integral cable strain relief clamps.
4. Panels shall accept factory manufactured fusion splice cassettes.
5. Provide blank covers over unused cassette openings.

C. Acceptable Products:

1. Fiber Termination Cabinets & Fusion Splice Cassettes Located in the MDF or IDF.
   a. 24-Fiber Singlemode duplex LC fusion splice cassette – Belden/CDT P/N FCS4H12LDFS. Provide 12-fiber OS2 singlemode fusion splice pigtails to terminate all singlemode fiber (Belden P/N FTSLD900PR123MY).
   b. Provide blank covers for all unused fiber termination panel cassette openings (Belden P/N FFZH00BB).
   c. No Substitutions.

2. Fiber Termination Cabinets & Fusion Splice Cassettes Located in MDF and IDF Rooms Where Shown on the Drawings:
   a. 2RU Cabinet - Belden/CDT P/N AX105564.
   b. 24-Fiber Singlemode duplex LC fusion splice cassette – Belden/CDT P/N FCS4H12LDFS. Provide 12-fiber OS2 singlemode fusion splice pigtails to terminate all singlemode fiber (Belden P/N FTSLD900PR123MY).
   c. Provide blank covers for all unused fiber termination panel cassette openings (Belden P/N FFZH00BB).
   d. No Substitutions.

2.13 OPTICAL FIBER PATCH CORDS

A. Provide duplex LC singlemode and multimode fiber optic patch cords for interconnection of owner furnished switches and fiber backbone cabling. Polarization of fiber optic patch cords shall comply with ANSI/TIA/EIA – 568-B.1 Section 10.3.3.

B. Fiber optic cabling shall comply with the requirements of ANSI/TIA/EIA-568-B.3 and ANSI/TIA/EIA-568-B.3 Addendum 1.

C. Fiber patch cords shall be manufactured of fiber optic cabling meeting the transmission characteristics of the fiber optic backbone cabling. The manufacturer of the fiber patch cord cabling and the fiber backbone cabling shall be identical.

D. For every installed 24-strand and 6-strand Singlemode fiber optic cable, provide qty (4) 3-meter duplex LC OS2 singlemode fiber patch cord (Belden/CDT P/N FPSLDLD003MR1XY).

E. Acceptable Products:
1. 3-Meter duplex LC OS2 singlemode patch cords – Belden/CDT P/N FPSLDLD003MR1XY.
2. No Substitutions.

2.14 TELECOM ROOM HORIZONTAL CABLE RUNWAY AND SUPPORTS

A. Horizontal cable runway, angle support brackets, butt splices, junction splices, mounting plates, elevation kits, grounding straps, etc. shall be provided by a single manufacturer. Installed system shall be grounded per ANSI/TIA-607-D.

B. Provide 18” wide horizontal universal style ladder rack in the telecom rooms where shown on the drawings. Ladder rack will be constructed of welded steel tubing. Stringers will be 1.5” in depth with 1.5” wide cross members spaced at 12” OC. Cable runway shall have a black finish.

1. Acceptable Products:

a. Chatsworth Universal Cable Runway - CPI Part Number 1125-718, alternate space cable runway – CPI Part Number 31472-718.
b. No Substitutions.

C. Provide 15” radius corner brackets at perpendicular intersections of the cable runway.

1. Acceptable Products:

a. Chatsworth Cable Runway Corner Bracket, 15 Wide (Black). CPI Part Number 11959-715.
b. No Substitutions.

D. Provide corner radius E-bends where shown on the drawings.

1. Acceptable Products:

a. Chatsworth Cable Runway E-Bend (Black). CPI Part Number 10822-718.
b. No Substitutions.

E. Provide qty (2) cable runway radius drops above each vertical cable manager to maintain cable bend radius. Coordinate layout of overhead ladder rack cross members so that radius drops are located directly above vertical cable managers. Where cross members conflict with the vertical cable managers, cut and remove cross members and replace with removable cross members. Where radius drops are connected to removable cross members, install custom radius drops. All components to have a black finish.

1. Acceptable Products:

a. Chatsworth Cable Runway Radius Drop, Cross Member (Black). CPI Part Number 12100-718 (for 18” wide runway).
b. No Substitutions.

F. Provide steel triangular support brackets to support the horizontal cable runway. Triangular support brackets shall be fastened to the stud wall framing. Spacing of the support brackets shall not exceed 4’-0” on center. Support brackets shall have a load capacity of 100 pounds (for 12” wide runway) and 400 pounds (for 18” runway) and shall have a black finish.

1. Acceptable Products:

a. Chatsworth Triangular Support Bracket, Steel, 12” and 18” Wide (Black). CPI Part Number 11312-712 (12”) and 11746-718 (18”).
b. No Substitutions.

G. Provide manufacturer’s butt-splice connections between continuous sections of horizontal ladder rack.

1. Acceptable Products:

a. Chatsworth Butt Splice Kit 1 ½” x 3/8” Stringer (Black). CPI Part Number 11301-701.
b. No Substitutions.

H. Provide manufacturer’s junction-splice connections at 90 degree intersections of horizontal ladder rack.

1. Acceptable Products:

a. Chatsworth Junction Splice Kit 1 ½” x 3/8” Stringer (Black). CPI Part Number 11302-701.
b. No Substitutions.

I. Provide cable runway wall angle supports.

1. Acceptable Products:

a. Chatsworth Wall Angle Support Kit, Cable Runway (Black). CPI Part Number 11746-718.
b. No Substitutions.

J. Provide cable runway elevation kit to secure the top of the equipment racks to the overhead ladder rack. Provide Qty (1) elevation kit per rack.

1. Acceptable Products:

a. Chatsworth Cable Runway 18” Elevation Kit (Black). CPI Part Number TS1069252. 3” Channel Rack-to-Runway Mounting Plate, 18” Wide (Black). CPI Part Number 10595-718.
b. No Substitutions.

K. Provide cable runway end closing kit to close unspliced ends of the cable runway.

1. Acceptable Products:

a. Chatsworth End Closing Kit, Cable Runway, 12” (Black). CPI Part Number 11700-712.
b. No Substitutions.

L. Provide cable runway ground straps to bond each section of the cable runway system together.

1. Acceptable Products:

a. Chatsworth Cable Runway Ground Strap. CPI Part Number 40164-001.
b. No Substitutions.

M. Install plastic dust protectors on exposed threaded rod supports (color black).

1. Acceptable Products:

a. Panduit Pan-Wrap split harness wrap.
b. Or approved equal.

2.2 VELCRO CABLE TIES

A. Provide Velcro cable ties cut to length from a continuous roll to loosely bundle horizontal cabling in the telecom rooms routed on the ladder rack to the patch panels. Install Velcro cable ties at 1’-0” intervals.

B. Do not exceed qty (24) cables per bundle.

C. Do not attach cable bundles to the runway with the Velcro cable ties. Do not use plastic tie-wraps.

D. Acceptable Products

1. Panduit HLS-15R6.
2. Leviton 43115-075.
3. Or approved equal.

PART 3 – EXECUTION

3.1 TELECOM EQUIPMENT ROOM COORDINATION

A. The electrical and telecom contractors are responsible for coordinating the installation of all equipment and cabling pathways located within the telecom rooms.

B. The electrical and telecom contractors shall coordinate the work of all other trades that have work located within the telecom equipment rooms.

C. The electrical and telecom contractors shall create and submit for approval coordinated scaled shop drawings of the telecom room showing the proposed location of all work. Shop drawings shall be submitted and approved prior to installing any work in the telecom rooms.

3.2 UTILITIES INSTALLED AND ROUTED THROUGH COMMUNICATION ROOMS

A. Telecom rooms are dedicated for the installation and support of telecom and security related equipment. Other equipment and utilities not specifically dedicated to the support of the telecom room are not permitted. This includes the telecom room and the space above the finished ceiling (where occurs) to the structure above. The following items are permitted:

1. Telecom and security related equipment and cabling.
2. Electrical panels, electrical outlets and uninterruptable power supplies directly serving equipment within the telecom room.
3. Electrical lighting and switches directly serving the telecom room.
4. HVAC ductwork, AC units, fan coil units and piping directly serving the telecom room.
5. Sprinkler piping directly serving sprinkler heads located in the telecom room.
6. Fire protection devices including smoke detectors and heat detectors directly serving the telecom room.

B. The following items are not permitted to be installed or routed through the telecom equipment rooms:

1. Electrical panels, transformers, feeders and/or conduit not specifically dedicated to the telecom room.
2. Fire alarm panels (unless specifically shown on the drawings or approved by the Owner’s representative).
3. HVAC ductwork, fan coil units, chilled water piping, heating hot water piping, and/or control panels not specifically dedicated to the telecom room.
4. Plumbing piping including cold water piping, hot water piping, condensate piping, waste piping and/or drain piping not specifically dedicated to the support of the telecom room.

C. Any utilities routed through a telecom equipment room that do not directly serve the room must be rerouted and/or relocated at the contractor’s expense.

D. Any equipment located in the telecom equipment rooms not directly serving the room shall be relocated at the Contractor’s expense.

E. Any utilities within a telecom room that pose a leak hazard to the equipment located within the room (with the exception of dedicated sprinkler piping) shall have a drip pan and appropriate drain piping installed to mitigate the leak risk.

3.3 FLOOR MOUNTED RACKS

A. Floor mounted racks and cabinets shall be secured to structure with a minimum of (4) 1/2” diameter concrete expansion anchors or as required by local codes.

B. Racks and cabinets shall be placed with a minimum of 36” clearance from the walls on at least three sides (two of which must be front and rear) of the rack. When mounted in a row, maintain a minimum of 36” from the wall behind and in front of the row of racks and from the wall to at least one end of the row.

C. All racks, free-standing cabinets, and wall-mount cabinets shall be bonded to the ground bar in each room with a separate #6 green insulated grounding conductor.

D. Rack mount cage nuts/screws not used for installing patch panels and other hardware shall be bagged and left with the rack or cabinet upon completion of the installation.

3.4 PLYWOOD BACKBOARDS

A. Mechanically fasten fire treated plywood sheets to the walls.

B. Install plywood on all 4 walls of the telecom room unless specifically noted otherwise on the drawings.

C. Run plywood sheets vertically from 6” AFF to 8’-6” AFF.

D. Where plywood will support backbone cabling, secure plywood to wall with sufficient fasteners to support 1,500 pounds of weight.

E. Paint plywood with 2 coats of white paint. Mask fire treatment labels on plywood prior to painting.

3.5 HORIZONTAL CABLE PATHWAY

A. Should vertical or horizontal clearances not be possible due to physical constraints of the designated space, the Contractor shall immediately contact the Owner’s Representative for alternative routing. Where the drawings indicate reuse of existing junction boxes, conduits, or pathway segments, verify existing pathway condition, capacity, continuity, and routing prior to use and maintain all specified bend radius, fill, pull-box, firestopping, grounding, and accessibility requirements.

B. Coordinate routing of cable pathway with lighting and HVAC serving the room. Secure cable pathway to walls, overhead structure and or equipment racks/cabinets as required.

C. Bond cable pathway sections together with #6 green insulated bonding jumpers. Bond pathway to telecom room ground bar with #6 green insulated conductor.

3.6 CABLE MANAGEMENT

A. Neatly bundle cabling with Velcro tie wraps on the horizontal ladder rack. Space Velcro tie wraps at 1’-0” on center.

B. Do not exceed qty (24) cables per bundle.

C. Neatly dress horizontal cable from the horizontal ladder rack, through the rear vertical cable managers to the rear of the patch panels. Use Velcro cable ties as necessary to maintain cable bundles. Do not exceed the manufacturer’s cable bend radius.

D. Do not install cable ties to bundle patch cables.

3.7 PATCH PANELS

A. Terminate and dress cables on the rear of the patch panels in accordance with manufacturer instructions using the provided rear cable management bar or bracket.

B. Maintain cable twists within ½” of the patch panel IDC blocks.

3.8 OPTICAL FIBER PATCH PANELS

A. Fusion splice all backbone fibers to duplex LC connectors and insert into the fiber termination cabinet bulkhead frames.

B. Secure backbone fiber cable sheath to the fiber patch panel with manufacturer supplied clamps. Route exposed fibers through fiber guides.

3.9 HORIZONTAL AND VERTICAL LADDER RACK

A. Install horizontal ladder rack at elevations shown on the drawings. Bolt horizontal ladder rack to tops of equipment racks with custom cable runway elevation kit.

B. Install vertical ladder to route cabling from floor sleeves to the overhead ladder rack.

C. Install vertical ladder to route cabling from overhead wall and deck conduit penetrations to the overhead ladder rack.

D. Install triangular ladder rack support brackets (knee braces) at a maximum of 4’-0” O.C. Secure support brackets to the stud wall framing with manufacturer’s recommended lag bolts.

E. Secure continuous sections of runway together with butt splices. Install “L” brackets to bolt together perpendicular intersections of runway. Install wall support angles at perpendicular intersections of the ladder rack to the wall.

F. Support and brace ladder rack from the building structure with threaded rod and Unistrut where runway is not routed adjacent to the wall and the span exceeds 4’-0”.

G. Seismically brace ladder rack and tops of equipment racks as required by local building codes.

H. De-burr all field cut sections of ladder rack prior to installation.

I. Install bonding jumpers between sections of ladder rack to maintain ground continuity.

J. Install touch-up paint to repair scratched or damaged ladder rack finish.

END OF SECTION 271100

SECTION 271300 – COMMUNICATIONS BACKBONE CABLING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the backbone cabling system, and to ensure that it is in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

C. Backbone cabling includes inter-building (Outside Plant) and intra-building (Premise) copper and fiber optic cabling.

D. This section includes minimum requirements for the following

1. Singlemode Tight Buffered Fiber Optic Cabling – Indoor/Outdoor
2. Multi-Pair Copper Cabling – Indoor/Outdoor

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 05 43: Exterior Communications Pathways
4. 27 08 00: Commissioning of Communications
5. 27 11 00: Communications Equipment Room Fittings

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of Specification Section 27 05 00 and in particular the following code requirements

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-568.3-D: Optical Fiber Cabling and Component Standard (Revision D, October 2016).
4. ANSI/TIA-598-D: Optical Fiber Cable Color Coding (Revision D, July 2014).
5. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
6. ANSI/TIA-758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard (Revision B, March 2012).

7. ANSI TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (Revision A, July 2015).
8. ANSI/TIA-526-14-C: Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant (Revision C, 2015).
9. ANSI/NFPA-70, 2023 - National Electrical Code (NEC).
10. Underwriter's Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

A. All materials shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacturer indicated. The equipment specified is based upon the acceptable manufacturers listed.

B. All fiber optic cabling and related fiber termination equipment shall be installed by a trained technician with a minimum of (2) years experience in the termination of fiber optic cabling. The technician will have received training through a nationally recognized program offered by BICSI, Corning, AT&T, 3M or equivalent. The contractor shall provide all specialized tools required for proper installation.

1.5 SUBMITTALS

A. Submit manufacturers' data sheets for the following

1. Singlemode Tight Buffered Fiber Optic Cabling – Indoor/Outdoor
2. Multi-Pair Copper Cabling – Indoor/Outdoor

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

C. Submit all factory test information of cables prior to installation of the product.

1.6 DELIVERY, STORAGE & HANDLING

A. Visually examine cable spools and boxes for damage after delivery to the jobsite prior to installation. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.7 GUARANTEE

A. The outside plant (OSP) and premise fiber optic cabling system including fiber termination cabinets, fiber connectors, fiber optic patch cords, etc. shall be covered by a 25-year system warranty from Belden/CDT.

PART 2 – PRODUCTS

2.1 SINGLEMODE TIGHT BUFFERED FIBER OPTIC CABLING – INDOOR/OUTDOOR

A. Provide cables with fiber strand counts as shown on the drawings.

B. Fiber optic cable shall be indoor/outdoor rated suitable for underground duct installation.

C. Fiber Optic cabling shall have a riser rated jacket (OFNR).

D. Fiber optic cables shall be tight buffered with a black colored jacket.

E. Maximum attenuation characteristics
   1. Maximum attenuation 0.80/0.50 dB/Km @ 1310/1550 nm.

F. Physical Characteristics
   1. Cable will have 900 µm buffer with mechanically strippable PVC jacket.
   2. The designation “UL” and “OFNR” shall be printed on the jacket with length markings every 2’-0”.
   3. The cable shall have individual fiber tube colors per TIA/EIA-606 and overall yellow jacket.
   4. The cable shall contain an aramid yarn strength member with cables stranded around center.
   5. The cable shall be suitable for operating temperatures of -40º to +70º C.

G. Acceptable Products:
   1. Belden/CDT P/N FDSD012R9 (24-Strand SM) and P/N FDSD006R9 (6-Strand SM).
   2. No Substitutions.

   1.

2.2 MULTI-PAIR COPPER BACKBONE CABLING – INDOOR/OUTDOOR

A. Shall be Category 5E and consist of a core of 24 AWG solid annealed copper conductors, color-coded in accordance with telephone industry standards.

B. Backbone cabling shall meet or exceed the Category 5E requirements listed in ANSI/TIA/EIA-568-B.

C. Provide quantity of backbone cables to meet pair counts as shown on the drawings.

D. Each 25 pairs shall be assembled in units and individually identified by color-coded unit binders.

E. Cable shall be indoor/outdoor rated suitable for underground duct installation.

F. Acceptable Products:
   1. Superior Essex P/N 51-499-EL.
   2. Or approved equal.

PART 3 – EXECUTION

3.1 BACKBONE CABLING

A. Ten (10) feet of fiber cable slack shall be stored at the telecom room in a figure eight configuration in the overhead ladder rack. Additional cable slack will be installed within the vertical cable managers in a "drip loop" configuration.

B. No more than 50’-0” of exposed “non-listed” outside plant cabling shall be permitted inside the building.

C. Vertical runs of cable shall be supported to a messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.

D. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.

E. Three feet of fiber slack shall be neatly coiled within the fiber enclosure.

F. Each optical fiber cable shall be individually attached to its enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure. Refer to manufacturer installation instructions.

G. Each optical fiber cable shall be clearly labeled at the entrance to the fiber termination enclosure. Cables labeled within the bundle where the label is obscured from view shall not be acceptable.

H. Prior to installation of fiber optic backbone cable, test one fiber strand using an OTDR or light meter to verify continuity of the cable.

I. All backbone fiber optic cabling and backbone copper cabling routed within conduit shall be installed in MaxCell fabric innerduct. Fabric innerduct shall be riser rated, sized for the conduit and cable quantities installed, and installed in accordance with the manufacturer’s written instructions. Secure innerduct at each conduit end, pull box, vault, sleeve, and telecom room entrance so that it remains accessible for cable placement and future cable removal. Do not leave innerduct unsupported or loose within pull boxes, sleeves, or telecom room ladder rack areas.

J. Within telecom rooms, route fiber optic cabling in 1-inch corrugated innerduct from the room entrance, conduit sleeve, or point of transition to the fiber termination cabinet or rack-mounted fiber enclosure. Terminate corrugated innerduct at the fiber enclosure using manufacturer-approved fittings, bushings, or strain-relief hardware. Maintain cable bend radius, provide required slack, and coordinate routing with ladder rack, vertical cable managers, patch panels, and other rack-mounted equipment.

3.2 OPTICAL FIBER CONNECTORS

A. Adhere to all manufacturer installation guidelines.

B. Polarization for entire system shall be maintained as described in ANSI/TIA/EIA – 568-B.1 Section 10.3.2.

3.3 COPPER CABLE TERMINATIONS

A. Terminate premise backbone copper cabling on rack mounted Category 5E voice patch panels. Maintain cable pair twists up to 0.5 inch of the point of termination for "Category 5E" Backbone distribution cables. Under no circumstances shall cable pairs be untwisted or otherwise altered prior to termination.

END OF SECTION 271300

SECTION 271500 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the horizontal cabling system, and to ensure that it is in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

B. The horizontal cabling is that portion of the communication cabling system that extends from the work area communications outlets to the patch panels in the communications rooms.

C. This section includes minimum requirements for the following

1. Horizontal Category 6 Cabling.
2. Horizontal Category 6A (Augmented) Cabling.
3. CAT 6A Patch Cords.
4. Category 6A 8-Position Jacks.
5. Category 6A Field Mount Plugs
6. Work Area 4-Port Plastic Faceplates
7. Velcro Cable Straps

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 05 43: Exterior Communications Pathways
4. 27 08 00: Commissioning of Communications
5. 27 11 00: Communications Equipment Room Fittings
6. 27 51 13: Paging Systems
7. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with Specification Section 27 05 00, the Contract Drawings, Washoe County School District Structured Cabling System Standard WCSD-SCS-015 dated March 13, 2023, and the following code and industry requirements.

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).

3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
4. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
5. ANSI/TIA-1152-A: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling (Revision A, November 2016).
6. Underwriter's Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

A. All materials shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specification shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and the manufacturer indicated. The equipment specified is based upon the acceptable manufacturers listed.

B. The Contractor shall strictly adhere to all Category 6 and Category 6A installation practices when installing unshielded twisted-pair cabling.

1.5 SUBMITTALS

A. Manufacturer's Data Sheets: Submit manufacturers data sheets for the following items

1. Horizontal Category 6 Cabling.
2. Horizontal Category 6A (Augmented) Cabling.
3. Category 6A 8-Position Jacks.
4. Category 6A Field Mount Plugs
5. Work Area 4-Port Plastic Faceplates
6. Work Area 4-Port Stainless Steel Faceplates
7. Velcro Cable Straps

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

1.6 DELIVERY, STORAGE & HANDLING

A. Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.7 GUARANTEE

A. The Category 6 and 6A horizontal cabling system including work area jacks, horizontal cabling, patch panels and patch cords shall be covered by a minimum 25-year system warranty from Belden/CDT (see section 270500 1.10 for warranty requirements).

PART 2 – PRODUCTS

2.1 HORIZONTAL CATEGORY 6 CABLE

A. Horizontal cabling shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Horizontal cabling shall be 4-pair, Category 6 unshielded twisted pair.

1. Physical Characteristics

   a. Category 6 cable shall meet or exceed the requirements of ANSI/TIA-568.2-D for balanced twisted-pair telecommunications cabling and components.

2. Cable shall have a listed plenum rated jacket (CMP).

3. The cable jacket must have the following legible markings

   a. Manufacturer's name.
   b. Copper conductor gauge.
   c. Pair count.
   d. UL and CSA listing.
   e. Manufacturer's trademark.
   f. Category rating.
   g. Sequential foot markings, in one foot increments.
   h. Jacket rating (CMP).

4. Horizontal data cable shall have a GRAY jacket with black lettering.

C. Transmission Characteristics

1. Cable shall conform to ANSI/TIA-568.2-D and shall be certified as Category 6 Permanent Link or Channel as applicable to the installed configuration.

Frequency (MHz)	Solid Conductor Cable Insertion Loss (dB)	NEXT Loss (dB)	PSNEXT Loss (dB)	ELFEXT Loss (dB)	Power Sum ELFEXT (dB)	Return Loss (dB)
1	2.0	74.3	72.3	67.8	64.8	20.0
4	3.8	65.3	63.3	55.8	52.8	23.0
8	5.3	60.8	58.8	49.7	46.7	24.5
10	6.0	59.3	57.3	47.8	44.8	25.0
16	7.6	56.2	54.2	43.7	40.7	25.0
20	8.5	54.8	52.8	41.8	38.8	25.0
25	9.5	53.3	51.3	39.8	36.8	24.3
31.25	10.7	51.9	49.9	37.9	34.9	23.6
62.5	15.4	47.4	45.4	31.9	28.9	21.5
100	19.8	44.3	42.3	27.8	24.8	20.1
200	29.0	39.8	37.8	21.8	18.8	18.0
250	32.8	38.3	36.3	19.8	16.8	17.3

2. Propagation delay skew shall not exceed 45 ns per 100 meters for all frequencies from 1 MHz to 250 MHz.

D. Acceptable Products:

1. Belden/CDT Gigaflex 2400 P/N 2413 08U1000 (jacket color gray).
2. No Substitutions.

2.2 CATEGORY 6A (AUGMENTED) HORIZONTAL CABLE

A. CAT 6A Horizontal cabling shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Horizontal data cabling for standard telecom outlets and wireless access points shall be 4-pair, Category 6A unshielded twisted pair.

C. Physical Characteristics

1. Category 6A cable shall meet or exceed the requirements of ANSI/TIA-568.2-D for Category 6A balanced twisted-pair telecommunications cabling and components.

2. Cable shall have a listed plenum rated jacket (CMP).

3. Cables shall be constructed of 4-pair, 23 AWG solid copper conductors.

4. The cable jacket must have the following legible markings

a. Manufacturer’s name.
b. Copper conductor gauge.
c. Pair count.
d. UL and CSA listing.
e. Manufacturer’s trademark.
f. Category rating.
g. Sequential foot markings, in one foot increments.
h. Jacket rating (CMP).

5. Horizontal data cable shall have a YELLOW jacket with black lettering.

D. Transmission Characteristics

1. Cable shall conform to ANSI/TIA-568.2-D and shall be certified as Category 6A Permanent Link or Channel as applicable to the installed configuration.

Frequency (MHz)	NEXT (dB) (min.)	PSANEXT (dB) (min.)	RETURN LOSS (dB) (min.)
0.772	96.2	112.2	70.2
1	94.0	110.0	68.0
4	82.0	98.0	56.0
8	75.9	91.9	49.9
10	74.0	90.0	48.0
16	69.9	85.9	43.9
20	68.0	84.0	42.0
25	66.0	82.0	40.0
31.25	64.1	80.1	38.1
62.5	58.1	74.1	32.1
100	54.0	70.0	28.0
200	48.0	64.0	22.0
250	46.0	62.0	20.0
300	44.5	60.5	18.5

350	43.1	59.1	17.1
400	42.0	58.0	16.0
450	40.9	56.9	14.9
500	40.0	56.0	14.0
550	39.2	55.2	13.2
600	38.4	54.4	12.4
625	38.1	54.1	12.1

2. Propagation delay skew shall not exceed 35 ns per 100 meters for all frequencies from 1 MHz to 625 MHz.

E. Acceptable Products.

1. Belden 10GXS CAT 6A Cabling. Belden/CDT Part Number 10GXS13 0041000 (jacket color yellow).
2. No Substitutions.

2.3 CATEGORY 6A FIELD MOUNT PLUGS

A. Field mount plugs shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Terminate CAT 6 cabling at all device locations for the following systems on CAT 6A field mount plugs and connect directly to the device.

1. CCTV System.
2. Audio Enhancement System.
3. Paging System.
4. Access Control System rough-in only, where specifically indicated on the Contract Drawings. Active access control devices, panels, readers, software, programming, and final system commissioning are not included in this Section unless expressly shown otherwise.

C. Terminate CAT 6A cabling at all device locations for the following systems on CAT 6A field mount plugs and connect directly to the device.

1. Wireless Access Points.

D. Field mount plugs shall be 8-pin Category 6A and will conform to the requirements of ANSI/TIA/EIA–568-B.2-10.

E. Pin/Pair assignment shall be in accordance with T568B.

F. Acceptable Products:

1. Belden/CDT RevConnect P/N RVAFPUBK-S1.
2. No Substitutions.

2.4 CATEGORY 6A MODULAR JACKS

A. CAT 6A modular jacks shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Modular jacks shall be 8-pin Category 6A and will conform to the requirements of ANSI/TIA/EIA–568-B.2-10.

C. Pin/Pair assignment shall be in accordance with T568B.

D. Modular jacks shall be manufactured by the same manufacturer as the patch panels in the telecommunication rooms.

E. Modular data jacks shall be color YELLOW.

F. Modular jacks shall be compatible with plastic faceplates and stainless steel faceplates.

G. Modular jacks shall be “Keystone” style.

H. Transmission characteristics for a mated-connection (jack and cord) shall conform to ANSI/TIA/EIA–568-B.2-10 as shown below.

Frequency (MHz)	NEXT (dB) (min.)	PSANEXT (dB) (min.)	RETURN LOSS (dB) (min.)
0.772	96.2	112.2	70.2
1	94.0	110.0	68.0
4	82.0	98.0	56.0
8	75.9	91.9	49.9
10	74.0	90.0	48.0
16	69.9	85.9	43.9
20	68.0	84.0	42.0
25	66.0	82.0	40.0
31.25	64.1	80.1	38.1
62.5	58.1	74.1	32.1
100	54.0	70.0	28.0
200	48.0	64.0	22.0
250	46.0	62.0	20.0
300	44.5	60.5	18.5
350	43.1	59.1	17.1
400	42.0	58.0	16.0
450	40.9	56.9	14.9
500	40.0	56.0	14.0
550	39.2	55.2	13.2
600	38.4	54.4	12.4
625	38.1	54.1	12.1

I. Acceptable Products:

1. Belden/CDT 10GX RevConnect Jacks P/N RVAMJKUYL-S1.
2. No Substitutions.

2.5 WORK AREA 4-PORT PLASTIC FACEPLATES

A. Faceplates shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Provide UL listed faceplates. Faceplates should be white (verify with Architect), flush mounted and manufactured of high impact thermoplastic.

C. Faceplates shall have top and bottom label holders with plastic inserts.

D. Provide faceplates with a minimum of 4 and a maximum of 6 modules. Provide blank inserts in unused openings.

E. Faceplates shall accept “Keystone” style modular jacks.

F. Faceplates shall be manufactured by the same manufacturer as the outlet jacks and shall be compatible with the submitted outlet jacks.

G. Acceptable Products:

1. Belden/CDT 4-Port Faceplate P/N AX102249 (color white) – verify color w/Architect.
2. No Substitutions.

2.6 WORK AREA 4-PORT STAINLESS STEEL FACEPLATES

A. Provide UL listed stainless steel faceplates at workstation outlets in the multipurpose room and where shown on the drawings.

B. Provide 4-port faceplates. Provide blank inserts in unused openings.

C. Faceplates shall accept “Keystone” style modular jacks.

D. Faceplates shall be manufactured by the same manufacturer as the outlet jacks and shall be compatible with the submitted outlet jacks. Provide “keystone” jacks as necessary.

E. Acceptable Products:

1. Stainless SG Faceplate. Belden/CDT AX102009.
2. No Substitutions.

2.7 VELCRO CABLE STRAPS

A. Loosely bundle horizontal cabling with Velcro tie wraps.

B. Velcro tie wraps shall ¾” in width and cut from a continuous roll.

C. Install Velcro cable ties at 2’-0” intervals outside of the telecom rooms and 1’-0” intervals inside the telecom rooms.

D. Do not exceed qty (24) cables per bundle.

E. Acceptable Products

1. Panduit TAK-TY HLSP (plenum).
2. Leviton 43115-075.
3. Or equal.

PART 3 – EXECUTION

3.1 HORIZONTAL CABLE ROUTING AND TERMINATION

A. Horizontal CAT 6 and CAT 6A cable routed in underground, under-slab, exterior, wet, or damp conduit shall be indoor/outdoor rated and suitable for wet locations while maintaining the required plenum or riser listing for the installed pathway.

B. Ten feet of cable slack shall be stored at the telecom room and three feet of cable slack shall be provided in the ceiling space above the telecom outlet for every installed horizontal cable.

C. All horizontal cables shall be installed in cable bundles. Cable bundles shall not exceed qty (24) cables per bundle and will be loosely bound with velcro straps. Cables in a bundle should be uncombed until entry into each rack's vertical cable management, where the cables are to be combed and dressed together until terminated on each patch panel.

D. Category 6 and Category 6A cables shall be bundled separately.

E. Cables shall be installed in continuous lengths from origin to destination with no splices unless explicitly shown on the Contract Drawings. Transition points, consolidation points or couplers shall not be used unless specifically detailed and approved by the Owner's Representative.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturers requirements and reference documents.

G. All telecom cables shall be supported by approved telecom pathways having dedicated support systems directly attached to structure (i.e. conduit, j-hooks, cable tray, etc.). Cables shall not be attached to or supported by ceiling grid, ceiling grid support wires, lighting fixture support wires or the work of other mechanical, electrical, plumbing or sprinkler trades.

H. All telecom cables shall be stored in accordance with the manufacturer’s requirements.

I. Any cable damaged or exceeding the manufacturer’s recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

J. All telecom cables shall be labeled with self-adhesive labels. At the work area outlet, the cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate. At the Telecom Room, each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cable labels located within the bundle or where obscured from view shall not be acceptable.

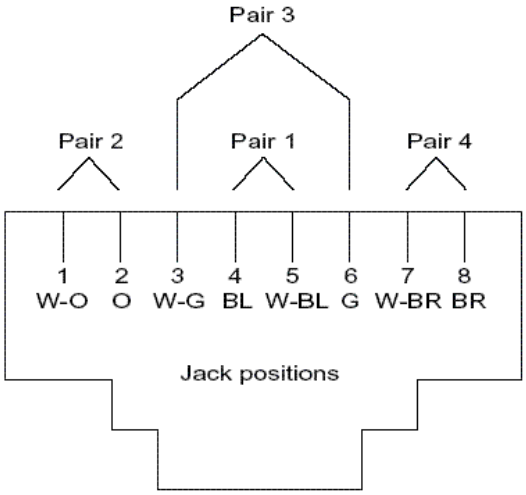
K. Cables shall be installed in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer’s recommendations and installation guides, and best industry practices.

L. Cables shall be installed in accordance with ANSI/TIA-568.0-E, ANSI/TIA-568.1-E, ANSI/TIA-568.2-D, manufacturer recommendations and installation guides, WCSD-SCS-015, and best industry practices.Plastic “zip-ties” shall not be permitted within the Structured Cabling System. “Velcro” type (hook and loop) tie wraps shall be used for the purpose of bundling / managing horizontal and backbone cabling (must be plenum rated if installed within a plenum space).

M. Horizontal UTP pair untwist at the termination shall not exceed 0.5”.

N. Jack pin/pair assignments shall be T568B for all installed horizontal cabling unless otherwise specified within the Project Documents.

1. T568B Jack pin/pair assignments are as follows:



O. For horizontal cabling, if a J-hook System is used to support cable bundles, all horizontal cables shall be supported at a maximum of 60” intervals. J-hooks must be secured to the permanent building structure. J-Hooks shall not be attached to ceiling tiles, ceiling grid, ceiling support wires or to the work of other mechanical, electrical, plumbing and sprinkler trades.

P. The horizontal telecom pathway and pathway support system shall not permit significant lateral or vertical motion. Cable quantities shall not exceed J-Hook System manufacturer recommendations or qty (24) cables, whichever is fewer.

Q. Telecom cables may not rest on acoustic ceiling grids or panels, or be attached to any portion of the building except for dedicated telecom pathway including conduit, innerduct, ladder rack, cable tray and/or J-hooks.

R. The cable length between the work area outlet and the termination in the telecommunications closet shall not exceed 295 feet. Any horizontal cable runs longer than 295 feet should be brought to the immediate attention of the Owner's Representative prior to installation.

S. When placing cable, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).

1. 6” clear from power conductors.
2. 12” clear from fluorescent lighting fixtures and ballasts.
3. 36” clear from transformers and motors.

3.2 WORK AREA OUTLETS

A. Work Area outlets and connectors shall be installed in accordance with manufacturer’s recommendations and installation guides, and best industry practices.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer's recommendations and best industry practices.

C. Pair untwist at the termination shall not exceed 0.5".

D. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.

END OF SECTION 271500

SECTION 274116 – CLASSROOM AUDIO ENHANCEMENT SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Provide all labor, materials, equipment, tools, transportation, storage costs, programming, testing, adjusting, tuning, training and all necessary and related items as required to provide complete and operational Classroom Audio Enhancement System as shown on the Drawings and described in the Specifications.

B. Section Includes:

1. Classroom audio enhancement system including Audio Enhancement MS-700 amplifier/receiver, speakers, speaker cabling, plenum CAT 6 network cabling, teacher/student microphones, microphone chargers, mounting accessories, configuration, testing, and owner training as indicated on the Drawings.
2. This Section supplements the Audio Enhancement equipment list and system notes shown on Sheet T021. Owner furnished, Contractor installed (OFCI) equipment and Contractor furnished, Contractor installed (CFCI) cabling shall be provided in accordance with the Drawings. The Contractor is responsible for installing, cabling, configuring, programming, adjusting, tuning, testing, demonstrating, and training for the complete audio enhancement system.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 08 00: Commissioning of Communications.
4. 27 11 00: Communications Equipment Room Fittings.
5. 27 15 00: Communications Horizontal Cabling.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REFERENCES

A. National Fire Protection Association (NFPA):

1. NFPA-70, 2023 -- National Electrical Code (NEC).
2. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).

3. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
4. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
5. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
6. ANSI S12.60:2002 Acoustic Performance Criteria, Design Requirements, Guidelines for Schools
7. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
8. ISO/IEC 18010:2002 (2002) – Pathways and Spaces for Customer Premises Cabling
9. ISO/IEC 14763-1:1999 (1999) – Implementation and Operation of Customer Premises Cabling, Part 1 – Administration
10. IEEE 1100 – IEEE Emerald Book

1.4 REFERENCES

A. ABBREVIATIONS

1. AV: Audio Visual.

1.5 SYSTEM DESCRIPTION

A. For each classroom and instructional space indicated on the Drawings, Contractor shall provide a complete Audio Enhancement classroom audio system. Scope shall match the Audio Enhancement System Oneline Diagram and equipment list on Sheet T021.

B. See Audio Enhancement equipment schedule on drawings for owner furnished, contractor installed (OFCI) and contractor furnished, contractor installed (CFCI) equipment and cabling.

C. Contractor installing the Audio Enhancement equipment shall be a certified installer for this equipment. Contractor to complete all required manufacturer training to obtain the necessary certifications. Alternatively, contractor shall hire Audio Enhancement to configure, test and commission the system.

D. Contractor shall provide a complete takeoff of all OFCI equipment and verify completeness with Audio Enhancement. Contractor shall submit a completed and approved takeoff to WCSD for purchasing of the Audio Enhancement equipment.

E. WCSD will purchase the OFCI equipment and will deliver to WCSD Edison warehouse. Contractor shall arrange pickup of the equipment from the warehouse.

F. Install flush 4 11/16" x 4 11/16" x 2 1/8" deep wall box with 1" conduit to accessible ceiling for mounting of the Audio Enhancement amplifier/receiver. Install (1) plenum cat 6 network drop from amplifier to telecom room. Terminate cat 6 cable at wall box on cat 6 field mount plug and connect directly to amplifier.

G. Provide (1) cat6 4' patch cord (jacket color grey) for each amplifier to cross connect to network switches in the telecom room.

H. Install ceiling mounted speakers in each classroom (see floor plans for speaker types and quantity). Provide and install 18/2 plenum cabling from speakers to wall mounted amplifier. Terminate, label and test cabling.

I. Install Audio Enhancement components and associated CAT 6 network drops as indicated on the Drawings. Coordinate amplifier, speaker, IP module, and mobile display interface requirements with the Audio Enhancement oneline and classroom layouts.

J. Furnish and install all A/V cabling and A/V patch cords as required for a complete and operational system. All A/V cabling to be plenum rated. A/V cabling shall be "pro-audio" grade suitable for commercial use. Submit cut sheets for approval of proposed hdmi, mini-stereo and speaker cable. Contractor to terminate, label and test all cabling.

K. Provide spreadsheet of amplifiers to WCSD IT department indicating mac address of device, classroom location, terminating telecom room, patch panel and patch panel port #. Assign IP addresses to amplifiers as directed by WCSD.

L. Pair teacher pendant microphone and student handheld microphone with wall mounted amplifier/receiver in all classrooms.

M. Install, configure, program and adjust all Audio Enhancement equipment to provide a complete and operational system.

N. The System is to include all equipment, materials, labor, and training as required to install and test a complete and operating System as described herein.

O. Awarded Contractor shall follow installation instructions provided by the manufacturer. Installation drawings shall show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.

P. Awarded contractor will be required to engage with the manufacturer to provide programming and commissioning of the complete operational system. Manufacturer agrees to work with the awarded contractor on each site, and provide those services to the contractor. Contractor is responsible for paying manufacturer for these services.

Q. Contractor shall examine the installation drawings and verify the conditions governing the work on the job site. Contractor shall arrange accordingly, providing such fittings, horizontal cable raceways, conduits, junction boxes and accessories as may be required to meet such conditions.

R. Deviations from the installation drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functionality or serviceability of the systems, shall not be made without the written approval of the Engineer.

S. Test and demonstrate the entire system at the completion of the project. Provide two (2) hours of training to the owner at the completion of the project.

1.6 ACTION SUBMITTALS

A. Provide Product Data Sheets: For each type of product required, demonstrating compliance with requirements.

B. Shop Drawings: Indicate the following:

1. Schematic diagram of circuits, conduits and equipment

1.7 INFORMATIONAL SUBMITTALS

A. Sample of manufacturer's warranty.

1.8 1.7 CLOSEOUT SUBMITTALS

A. Operating and maintenance instructions.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualification: Manufacturer of system with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.

B. All miscellaneous equipment required for a complete, professional installation shall be included in the base bid by the contractor. The district will supply the equipment provided as part of this base bid, no allowances for any additional equipment, hardware, cabling, or miscellaneous will be considered unless specifically excluded from the base bid. Contractor is responsible during the bidding process to include any additional materials needed to install these systems.

C. All work materials shall be removed at the end of the work day and the work area left in the same condition as found.

D. The work herein specified shall be performed by fully competent workmen, in a thorough manner. All materials furnished by the Contractor shall be new, and all work shall be completed to the satisfaction of the Architect/Engineer.

E. All equipment shall be held firmly in place. This shall include speakers, receiver/amplifiers, cables, etc. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three. All switches, connectors, outlets, etc., shall be clearly, logically, and permanently marked during installation.

F. The Contractor must take such precautions as are necessary to guard against electromagnetic and electrostatic hum and ground loops, to supply adequate ventilation, and to install the equipment so as to provide maximum safety to the person who operates it.

G. Care shall be exercised in wiring so as to avoid damage to the cables (e.g., stapling, pinching, excessive bending) and to the equipment. All joints and connections shall be made with lead-free rosin-core solder or with mechanical connectors approved by the Engineer. All wiring shall be executed in strict adherence to standard broadcast practices.

H. The Contractor shall be an established communications and electronics Contractor that has had and currently maintains a locally run and operated business for at least five years. The Contractor shall utilize a duly authorized reseller of the equipment supplied for this project location with full Manufacturer's warranty privileges.

I. The Contractor shall test the installed System according to the Manufacturer’s instructions and verify that the equipment has been installed properly and is functioning as designed.

J. Manufacturer Qualifications: Approved manufacturer of components listed in this Section with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.

1. Approval of Comparable Products: The district will be providing the equipment for this specification – no substitutions will be allowed.

K. Regulatory Requirements: Provide components and systems that comply with requirements of the following:

1. Refer to Section 1.2 A.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of controls system that fail in materials or workmanship within the specified warranty period following substantial completion.

1. Warranty Period: Wireless transmitters, wireless receivers, amplifiers, loudspeakers, controllers, alert notification station and microphone chargers: 5 years.
2. Warranty Period: Rechargeable batteries, power cords, power supplies: 1 year.

B. Manufacturer's Extended Support Service: Extended telephone support: Unlimited period.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Owner will provide products from:

1. Audio Enhancement, Inc., Bluffdale, UT 84065, Phone +1 801 254 9263, www.AudioEnhancement.com.

2.2 CLASSROOM AND INSTRUCTIONAL SPACE AUDIO ENHANCEMENT & SAFETY ALERT SYSTEM

A. For each classroom and instructional space indicated on the Drawings, Contractor shall install a complete Audio Enhancement classroom audio system including OFCI and CFCI components identified on Sheet T021. Each system shall include but not be limited to:

1. One Audio Enhancement MS-700 amplifier/receiver per classroom or instructional space, Owner furnished and Contractor installed where indicated.
2. One DECT Teacher microphone
3. One DECT Student microphone
4. One dual microphone charger
5. One Classroom Amplifier which provides connections for AV control panel, speakers, receivers etc. Any external connection blocks or other accessories shall be supplied to provide for a complete, functional system.
6. System must provide DECT wireless transmission of AV sources from a mobile display to receiver.

7. Ceiling or wall mounted speakers as indicated on the Drawings and Audio Enhancement equipment list. Provide 18/2 plenum speaker cabling from speakers to the classroom amplifier.

A. DECT Receiver specifications:

1. Transmission type: DECT RF
2. Frequency response: 50Hz to 10kHz
3. Signal to Noise: > 65dB (system)
4. THD: < 1% @ 1kHz
5. Power Supply: Supplied by MFG – appropriate to system used
6. USER CONTROLS –Controls from the teacher microphone only

    a. Teacher Microphone Volume Control
    b. Student Microphone Volume Control
    c. Line (Multi-Media) level Control

7. INPUTS/OUTPUTS:

    a. Input power jack
    b. Audio out jack
    c. Line Input jack

B. Teacher microphone specifications:

1. Transmission type: DECT RF
2. Frequency response: 70Hz – 8kHz
3. Microphone: Unidirectional cardioid
4. Battery life: 7 hours (typical)
5. Battery type: NiMH or Li-Ion
6. USER CONTROLS:

    a. Own/Other/Line Volume Controls
    b. Power
    c. Mute
    d. Special Function Control (Duress Button)

7. INPUTS/OUTPUTS:

    a. 3.5mm aux input
    b. 3.5mm External Mic Input Jack
    c. Micro USB Charging Jack

C. Student microphone specifications

1. Transmission type: DECT RF
2. Frequency response: 70Hz – 8kHz
3. Microphone: Unidirectional cardioid
4. Battery life: 7 hours (typical)
5. Battery type: Li-Ion or NiMH
6. USER CONTROLS:

    a. on/off
    b. push-to-talk

7. INPUTS/OUTPUTS:

    a. 3.5mm aux input
    b. Micro USB Charging Jack

D. Dual microphone charger specifications:

1. Provide a Dual USB Charger
2. Provide a Micro USB to USB-A cable for each microphone

E. Amplifier specifications:

1. Inputs/Outputs:

    a. input power jack
    b. Minimum of 3 Audio Inputs – 3.5mm Jacks
    c. RS232 serial control
    d. loudspeaker terminals
    e. Audio output (3.5mm)
    f. Serial Baud rate: 2400 to 115200 baud

2. Power supply: Supplied by MFG – appropriate to system used
3. Minimum output power: 2 x 8w (8 Ω), 2 x 16w (4 Ω)

F. Ceiling Speaker specifications – In most cases, the rooms being supplied will have drop tile ceilings and should always have ceiling speakers installed overhead of the listeners.

1. Average sensitivity: 86dB-SPL 1W/1M
2. Impedance: 8Ω nominal
3. Continuous power: Minimum 30W
4. Peak power: Minimum 45W
5. Frequency response: 60Hz to 20kHz
6. Mounting: Metal tile bridge, steel back enclosure, built for Plenum spaces
7. Speaker wire: 18 AWG 2 conductor UL listed CL3P Plenum-rated

G. Wall Enclosure specifications

1. Provide a wall enclosure that is sized appropriately to accommodate the amplifier and microphone receiver in each classroom

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to installation, examine work area to verify measurements, and that commencing installation complies with manufacturer's requirements.

3.2 INSTALLATION

A. Comply with requirements of Division 27 Sections "Common Work Results for Communications."

B. Do not install AV or control devices until space is enclosed, HVAC systems are running, and overhead and wet work in work space are complete.

C. Install all AV and Network devices in accordance with manufacturer's instructions. Installer must be approved or certified by manufacturer to install equipment.

D. Install speakers in accordance with manufacturer's instructions.

E. Grounding: Provide electrical grounding in accordance with NFPA 70.

F. Perform setup for each audio-visual equipment component.

G. Contractor is responsible to contract with the manufacturer to provide all programming services for the district supplied equipment

3.3 SYSTEM STARTUP AND TESTING

A. The contractor installing the Audio Enhancement system is responsible for installing, startup, adjusting and testing the equipment in accordance with manufacturer's recommendations.

B. Perform operational testing to verify compliance with Specifications. Adjust as required.

3.4 CLOSEOUT ACTIVITIES

A. Commissioning

1. Commissioning services will be provided by the manufacturer and will be mandatory for the contractor to complete the demonstration requirement in this section of the specification. Contractor shall be responsible for the equipment manufacturer’s commissioning costs.
2. Contractor will be responsible to work with the equipment manufacturer to provide complete commissioning services.

B. Demonstration: The Contractor shall demonstrate the System to operate in accordance with the requirements of these specifications as well as the Manufacturer’s performance specifications. The test shall be performed in the presence of an authorized representative of the Owner.

C. Should such a demonstration of performance show that the Contractor has not properly installed the System, the Contractor shall make all changes or adjustments at no additional cost to the Owner.

D. Training: Train Owner's personnel to operate, maintain, and program AV and Safety systems

END OF SECTION 274116

SECTION 275113 – PAGING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY OF WORK

A. This section includes a fully operational IP platform for a district-wide internal and school Critical Communications Solution, incorporating school safety notifications and general communications including but not limited to the following:

1. The platform shall provide complete internal communications and employ state of the art IP Technology including the minimum functions listed.

a. Two-way internal intercommunications between staff locations and classrooms.
b. Scheduled bell events.
c. Emergency announcements that will override any pre-programmed audio, assuring that all Emergency/Lockdown etc., are heard at each and every speaker location.
d. Capability of prerecording emergency announcements that can be activated by a Soft Key on an administrative console, panic button, dial string, or web browser.
e. Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone.
f. District-wide, Emergency, Group, All School and Zone live voice paging.
g. District-wide, Emergency, Group, All School and Zone paging for pre-recorded audio – tones, music and voice.
h. Web-based user interface.
i. “Code Red” push button to initiate pre-recorded lock down announcement.
j. Status indicator lights adjacent to all clocks (flush j-box, blank cover plate and conduit roughin only – status lights and cabling are future).

2. The system shall support a minimum of 1000 level priorities which shall be user-definable, allowing each end point to place a minimum of 5 different priority calls at the same time.
3. Any authorized administrator shall be able to call from outside the school into any classroom, zone, or entire school directly via the School District supplied SIP enabled Telephone Network. This shall allow remote monitoring, call-in annunciation, and two-way conversation from outside the facility as well as paging into the system. (Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools).
4. Authorized system users shall be able to create a minimum of 100 automated sequences with voice instructions, tones, emails, program distribution, and relay activations and replay them.

5. Automated message strings shall be manually initiated from a single-button access on the console, on a SIP connected telephone, a panic button, from the web-based user interface or via interface with third party systems.
6. Paging and two-way intercom features shall be accessible from any system console or SIP connected telephone for each campus.
7. The platform shall synchronize its system time to the network timeserver or a web-based time server.
8. Each single campus installation shall be locally survivable for intercom, paging, bells, and emergencies such as lockdown, even when the district connection is unavailable.
9. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.
10. Systems that do not comply with the feature-sets highlighted in this Specification will not be considered.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 08 00: Commissioning of Communications
4. 27 11 00: Communications Equipment Room Fittings
5. 27 15 00: Communications Horizontal Cabling
6. 27 41 16: AV and Safety Alert Systems
7. 27 53 13: Synchronized Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 DEFINITION OF TERMS

A. Installer(s): Shall refer to the person, persons, or company who or which actually contracts to perform the work specified herein.

1.4 SUBMITTALS

A. Product data for each component.

B. Shop Drawings: Prior to proceeding with the work: Provide detailed equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, location of each field connection, and a complete schedule of all equipment and materials with associated manufacturer’s product data sheets which are to be used.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components and levels throughout system and impedances.
2. Drawings and lists indicating proposed nameplate nomenclature and arrangements for control panels and plug panels prior to fabrication reflecting equipment used.
3. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled. All drawings shall have the name and locations of the project, Systems Contractor's name in the title block.
4. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment, furnished.

C. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems, which are not FCC approved or utilize an intermediary device for connection, will not be considered. Provide the FCC registration number of the system being proposed as part of the submittal process.

D. Product Certificates: Signed by manufacturers certifying that products furnished comply with specified requirements.

E. Installer Certificates: Signed by manufacturers certifying that Installers comply with specified requirements.

F. Manufacturer Certificates: Signed by manufacturers certifying that they comply with specified requirements.

G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

H. Maintenance Data: For equipment to be included in maintenance manuals specified in Division 1.

1. Record of Owners equipment-programming option decisions.
2. All instructions necessary for proper operation and manufacturer's instructions.
3. "Proof of Performance" information.
4. Manufacturer's maintenance information.
5. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.

I. As-Built Drawings: Prior to final acceptance, provide as-built drawings in PDF format indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing".

J. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and in accordance with Division 1 specifications.

1. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner's representative.
2. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
3. Include with the submittal a current copy of trainer's needs assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.
4. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.

K. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section. Provide the following within thirty (30) days after notification to proceed:

1. Provide a list of installations that the Installer has specifically installed for verification by the Owner. Random installations from other vendors and/or Installers shall not be accepted. The Installer, not its employees, must meet these qualifications.
2. The Installer shall be bondable.
3. The Installer shall demonstrate to the satisfaction of the Owner or his representative that he has:

    a. Adequate plant and equipment to pursue the work properly and expeditiously.
    b. Adequate staff and technical experience to implement the work.
    c. Suitable financial status to meet the obligations of the work.
    d. Technically capable and factory trained service personnel at a local service facility to provide routine and emergency service for all products used in this project.

B. Any Contractor, who intends to bid on this work and does not meet the requirements of the "Quality Assurance" paragraph(s), shall employ the services of an "Installer" who does meet the requirements and who shall provide the equipment, make all connections and continuously supervise the installation. A subcontractor so employed as the "Installer" must be acceptable to the

Architect/Engineer. The "Installer" shall be identified within thirty (30) days of notification to proceed for acceptance by the Architect/Engineer.

C. Because the life expectancy of this type of communications structure normally exceeds 10 years, the owner expects continuity from the service provider. If the installing/servicing company has not been an authorized provider of the manufacturers product for at least three (3) years, the following is required:

1. A list of (2) systems manufacturers of which they currently are authorized service providers where the relationship exceeds three (3) years.
2. A letter from the manufacturer outlining the details of changes in service providers over the last three (3) years and what actions they will take to ensure continuity of service to the customer.

D. Each major component of equipment shall have the manufacturers name, address and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, UL Label, or other data that is die-stamped into the surface of the equipment shall be easily visible.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Comply with NFPA 70

G. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.

H. Comply with UL 60950.

1.6 IN-SERVICE TRAINING

A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.

B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.

C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the staff and faculty members who attended, received, and completed the training program.

1.7 WARRANTY

A. Provide a manufacturer's five-year warranty of the school communications network equipment against defects in material and workmanship. This warranty will cover all electronic system components. Additional warranties cover clocks, speakers, and call in switches. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a one year warranty shall be provided for labor.

B. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary. The standard five-year warranty is an important element in establishing a standard in quality. Manufacturers who circumvent the five-year warranty by offering special "extended warranties" that are not part of their normal published warranty will not be accepted.

C. Contractor shall respond, excluding weekends and holidays, within 24 hours to any warranty service calls. If equipment cannot be repaired within 24 hours of service visit, the contractor shall provide "loaner" equipment to the facility at no charge.

D. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

1.8 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide the following system:

1. Telecenter manufactured by Rauland

a. Authorized Rauland Distributor contact:

(1) Jeff Bowers
Innovative Communications Systems, Inc.
775-825-2011
jbowers@innovativecomsys.com

PART 2 – PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. The platform shall utilize state of the art IP Technology for Call-in Notification, School Safety Paging and Evacuation tones, Atomic Time Synchronization, Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way hands-free Internal Communications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web-based and user friendly to allow the system administrator the ability to easily program system features.

B. Provide complete and satisfactorily operating district/school communications and district/school safety as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

C. The platform shall be a single electronic system consisting of a minimum of 10 audio channels for each campus, (classroom) IP Speaker Modules and call switches, IP Zone Modules connecting corridor speakers, inside and outside horns, IP Administrative Consoles, SIP enabled PBX integration and district-wide integration for paging, emergency notifications, calendar scheduling and configuration.

D. Each Classroom shall be provided with a Speaker Module interface and a minimum of 5 different call switches, each with their own annunciation path and priority.

E. Call-ins may automatically annunciate (display of priority and location) to administrative consoles, SIP enabled phones, and outside phones.

F. Call-ins shall be programmed to automatically change priority and annunciation route based on age of call-in and original priority.

G. Call-ins may have priority (and annunciation route) changed by user action from a console or SIP enabled phone.

H. Call-in annunciation route shall include playing pre-recorded audio over speakers, sending a pre-configured email, and activating relays.

I. The platform shall lend itself to expansion by simple addition of hardware modules.

J. The platform shall connect directly to an existing, standard protocol WAN/LAN network, without the need for a separate server at each school location. Configuration, including bell schedules, calendars, and emergency sequences can be remotely created, changed, stored and downloaded to the system by an authorized user from a web-based user interface.

K. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone or connected web browser within the facility or outside the facility to any other location within the facility or district.

L. The platform shall provide the ability to selectively communicate or monitor individual classrooms in emergency situations from any telephone within the facility or outside the facility to any other location within the facility; all communication within the classroom shall be hands-free and will not require any interaction by the classroom user.

M. The platform shall provide classroom users the ability to confirm that they have safely secured their classrooms during an emergency with a single button press. The front office administrator will receive confirmation that the classroom is safely secured via an administrative console and web-based user interface. The front office administrator can view classrooms that are not safely secured via the administrative console. The front office administrator can view classrooms that are not safely secured via the web-based user interface. The front office administrator shall be able to initiate two-way communication, without a pre-announcement tone, to the classroom during an emergency via the administrative console. Web-based user interface will still identify that a school is in an emergency, even if all classrooms are safely secured. Individual classroom check-in and school emergency status shall be viewed from the web-based user interface, both on-site and remotely.

N. IP Addressable and POE powered Speaker Modules for individual rooms shall be system programmable and may be assigned any two, three, four, five or six digit number as well as name and description. Any extension may be reassigned at any time.

O. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in a campus. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active, complying fully with all privacy legislation. Pre announce tone and supervisory tones shall be disabled during designated emergencies automatically.

P. The platform shall allow users to configure multiple schedules per school, with a minimum of 500 unique events per schedule, and automatic Daylight Savings time correction. Schedules can be programmed to occur once, daily, weekly, monthly, or in any combination of the preceding recurrences. Each school may have a minimum of 20 unique bell schedules, with a minimum of 5 active schedules on any given day for each campus. User shall be able to select from 25 standard included tones as well additional user created and uploaded audio files for class change signaling and messaging. In addition, scheduled events shall include relay actions, email notifications, and paging exclusions as system configuration changes. The platform shall allow control of the bell schedules via the district WAN/LAN without the need for a separate server at each school location. Bell schedules can be remotely created, changed, stored and assigned to calendar days for the local school by an authorized user from a web-based user interface.

Q. The platform shall be able to integrate with an existing PA system or operate as a fully independent IP solution. The platform shall be able to function in combination of said configurations, and allow for seamless communication within a school or district-wide, regardless of the type of configuration used. The platform shall be scalable, with the ability to easily add, install, and configure additional equipment to a system.

R. The platform allows for customization of preprogrammed sequences, used for emergencies, events, and everyday communications. Preprogrammed sequences can be activated from the push of a relay button, soft key of an administrative console, a dial string of a SIP phone, or a web browser configured to the district network. Sequences can be initiated automatically as part of a schedule or on the fly. Preprogrammed sequences can be customized to utilize any combination of audio tones, emails, relays, tone exclusions, swings, delays, duples, SIP phone notifications, and program distribution. Audio tones can include customized audio files and voice messages, recorded in any language. Uploaded audio tones and messages can be preprogrammed to annunciate repeatedly or individually, as part of a scheduled sequence or on the fly. Each school in a district can have its own customized sequences, and can be activated individually, in groups, or district-wide.

2.2 EQUIPMENT AND MATERIAL

A. Server Software

1. Provides district-wide paging, bell event scheduling, emergency notification and configuration for entire district.
2. Ability to configure system and initiate system features, per school and district-wide via web-based user interface.
3. The software has the ability to sync system time to the Atomic Clock Signal or to the school's or district's network time server.
4. The software will provide a web browser to deliver district-wide emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the district. The software must be capable of automatically notifying district personnel via the WAN/LAN of an alarm condition.
5. The software can automatically broadcast emergency instructions via associated system hardware throughout an entire district when an alarm (e.g. lockdown, lockout, security, fire) is initiated via the web-based user interface. The emergency instructions are preprogrammed and require no user intervention. Bell tones are able to be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
6. The software allows for user-uploaded pre-recorded messages and tones. Software supports the upload of MP3 and WAV file types. User-uploaded pre-recorded messages and tones can be part of emergencies, sequences, and bell schedules.
7. The software can be installed in cloud, virtual or physical server environments.
8. The web-based user interface supports secure HTTP browsing.
9. The software supports encryption to ensure secure access.
10. The system shall monitor itself if devices go offline and system actions are not received. Specified users shall receive email notifications when devices go offline. The software shall be able to keep a log and report on system activity within a school or all schools district-wide for a minimum of one year. These reports can be exported to excel spreadsheets.

11. The software will support a minimum of 20 bell schedules per school, with 5 schedules assignable to a specific school day. Bell schedules can be programmed to annunciate tones, activate relays, send emails, activate program distribution, and notify SIP phones.
12. The system allows programmable end points to be automatically included or excluded for live paging, bell tones, or prerecorded audio, depending on the time or day or day of the week. These inclusions/exclusions can be applied manually or automatically depending on their schedule.
13. The software can automatically send an email, as part of a programmed sequence of events, to district administrators alerting them of an emergency within the district.
14. The software provides the ability to view schools that are in an emergency status, using any web browser on the district's network. The software shall identify the name of the school in an emergency as well the type of emergency that school is in.
15. The software provides the ability to view individual classrooms that are not checked-in during an emergency, using any web browser on the district's network. The software shall identify the name, extension, and description of the classroom that is not checked-in during the emergency.
16. The system has a minimum of 5 customizable emergencies, one of them being an All-Clear – with the ability to return the system from an emergency to normal status. Each emergency shall have a minimum of 500 unique events.
17. As a district-wide communications solution, the system shall be able to provide simultaneous communications to all schools or groups of schools within a district. The system shall allow a user to initiate district-wide communications to individual schools, all schools or groups of schools, from a web-based user interface. The system shall allow a user to initiate prerecorded audio, live paging, or programmed sequences to individual schools, all schools or groups of schools, from the web-based user interface. Programmed sequences shall be customizable per school, and the system shall be able to activate them simultaneously to individual schools, all schools or groups of schools, from the web-based user interface.
18. The communications software must allow upgrade from an individual school system to multiple schools, or an entire school district, using the same web-based user interface. The communications software from an individual school system must be identical in typical user operation to the multiple schools or entire school district communications system software.

B. Campus Controller

1. Provides call routing for paging and intercom for a single facility.
2. System shall connect to the district provided Telephone Network via a SIP connection.
3. Support a flexible numbering plan allowing two, three, four, five, or six digit extensions.
4. SIP interface to a district provided Telephone Network shall be capable of allowing connected phones to display classroom call-ins, answer

internal intercom call-ins, make pages and change priorities of call-ins in progress.

5. Direct dialing, two-way amplified voice intercom between any provided telephone or admin console and speaker without the use of a press-to-talk or talk-listen switch.
6. Ability to upgrade priority level from individual call switch.
7. The ability to answer intercom call-ins registered at administrative consoles and pre-selected telephones.
8. The ability to automatically escalate incoming call-ins to an alternate telephone or group of telephones if they remain unanswered for a predetermined amount of time.
9. The ability to manually upgrade an intercom call-in to an alternate telephone or group of telephones.
10. The ability for classrooms to "check-in" via push button when they have successfully secured their location during emergency.
11. Administrative console shall display locations that have not checked in to confirm their secured location and provide hands-free audio monitoring and communication to unsecured locations.
12. The controller shall not need direct connection to any classroom via home run or distributed wiring. It shall communicate solely through the IP network.
13. Single button access from any console on the system to distribute emergency announcements within the facility to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative console shall have priority over all regular system functions.
14. Ability for administrative consoles and connected phones to selectively monitor audio at any two way speaker during an emergency.
15. Stores a minimum of 48 hours' worth of Bell Event Schedules, all emergency notification sequences as well as facility wide configuration.
16. System has the ability to sync system time to the Atomic Clock Signal or to the school's or districts network time server.
17. System's SIP Interface shall provide:

    a. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire facility.
    b. Ability to answer a call-in directed to that SIP extension.
    c. Ability to upgrade a call-in directed to that SIP extension.
    d. Single button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
    e. Ability to initiate a school-wide emergency including lockdown and evacuate sequences.
    f. SIP device shall display call-in information from call in switch. Information will include a minimum of Classroom Name, Number, and Priority Level.

18. The system will have the ability to utilize a web browser and a USB microphone connected to the PC to deliver district-wide live emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the district. The system must be capable of automatically notifying district personnel via the WAN of an alarm condition.
19. The system can automatically broadcast emergency instructions throughout an entire campus when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. Bell tones are able to be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.

C. IP Addressable Modules:

1. System shall provide multiple IP Addressable Modules for intercom, paging and relay activation.

    a. All Modules are POE 802.3af compliant
    b. All Modules support DHCP.
    c. All Modules connect to network with a single RJ45 connector

2. IP Addressable Speaker Module

    a. Shall interface to school's data network, a classroom speaker, and multiple call switches.
    b. A minimum of 5 levels of call-in can be placed from an IP Speaker Module. The call-ins are routed to administrative consoles and select SIP connected telephones and can only be cleared from the system once answered. If a call-in is not answered within a preprogrammed time the call-in may reroute to other telephones, consoles, and speakers.
    c. An option for Privacy call in switches is supported. When the Privacy switch is activated it prevents administrative or classroom telephones from monitoring the specific classroom/location intercom speaker.
    d. The ability to belong to one or more of a minimum of 100 independent zones for zone paging, program/music distribution zones and class change tone zones; this assignment is a programmable function, changeable by time of day. Each IP Speaker Module's location shall be programmed in software to belong to any combination of software zones. IP Speaker Modules shall be designed to mount near ceiling and wall speakers and in the plenum space.
    e. Intercom and paging volume adjustable from Software interface.

3. IP Addressable Zone Paging Module

a. Zone Paging Module shall connect multiple speakers for district all page, all page, zone paging, bells, audio events and, emergency notification.
b. Zone Paging Modules shall be rack and wall mountable.
c. Zone Paging Modules shall be able to belong to one or more of 100 independent zones for live paging, bells, pre-recorded audio and emergency notification.

4. IP Addressable Aux I/O Module

a. Aux I/O Module shall have two input contacts and two output contacts.
b. Input and output contacts are individually addressable.
c. Aux I/O Module shall be wall and rack mountable.
d. User can program relays to be activated manually, through an event/bell schedule, or during emergency notification.
e. Aux I/O Module can perform school lockdown from a single press of a panic button.

5. IP Addressable Program Line Input Module

a. Program Line Input Module shall provide line level audio program distribution into system.
b. Program Line Input Module shall have a 3.5mm cable jack.
c. Program Line Input Module shall be configured via web-based user interface.
d. User can configure program distribution to be activated manually or automatically through an event/bell schedule.
e. Program Line Input Module will have a system priority level such that emergency communications override program distribution.

D. IP Addressable Analog Gateway

1. IP Addressable Gateway provides integration with existing analog wiring infrastructure – consisting of shielded two-pair classroom field wiring. The Gateway provides the ability to reuse speaker wiring, speakers, and punch blocks to integrate analog infrastructure with IP platform.
2. Each Gateway will have 5 watts of power per port and 25 watts total per device.
3. Supports 24 classrooms that utilize 25 Volt speakers and all current Telecenter call switches for front office notification.
4. Supports minimum of 5 call switch priorities per classroom, capable of lockdown check-in functionality, while reusing existing shielded two-pair classroom field wiring.
5. Classroom intercom volume adjustable from Software interface.
6. Classroom paging volume adjustable from Software interface.
7. Configured to the school network and can be used in conjunction with IP Addressable Modules.

E. IP Addressable Administrative Console

1. A full color screen with 64 soft keys, 3 line select, volume control, push to talk, speakerphone mode and left/right and up/down scrolling.
2. Audio paging access from any Console to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire school.
3. Programmable soft key access from any console on the system to initiate alarm signals within the school to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative console shall have priority over all regular system functions.
4. Programmable soft key access from any console to automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
5. Ability to perform intercom to any single IP Addressable Speaker Module.
6. Ability to display 3 call-ins at a time on the screen while other call-ins are annunciating and the ability to scroll to view all call-ins.
7. Ability to upgrade a call-in via soft key.
8. Programmable soft key access from any console for activating relays, campus wide.
9. Ability to maintain, along with controller and other IP Modules system functions, including intercom, bells and paging for the local campus in the event of district-wide connection loss.
10. Classrooms that have not 'checked-in' during an emergency are listed on the Administrative Console's screen.
11. The time duration of an emergency is shown on the screen of the administrative console. The check-in timer is shown on the screen of the administrative console.

F. Audio Paging/Program Amplifiers

1. Power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging speakers, and 15 watts of power to all paging horns.
2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.

G. Normal/Emergency Call Switch – Rauland Dual Level Call In Switch

1. Normal/Emergency Call Switches indicated on the drawings shall provide the following functions and features:

    a. One (1) "Normal" call switch that shall activate a distinctive "NORMAL" level call from single button activation. The button shall be clearly marked "NORMAL" and will route the call-in to any one or more Administrative Consoles and/or Marquee

Displays for quick and easy response from an Administrative Console.

b. One (1) “Emergency” call switch that shall activate a distinctive “EMERGENCY” level call from single button activation. The button shall be red in color and shall be clearly marked “EMERGENCY” and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.

H. Emergency/Check-In Call Switch – Rauland Check-In Call In Switch

1. Emergency/Check-In Call Switched indicated on the drawings shall provide the following functions and features:

a. One (1) “Emergency” call switch that shall activate a distinctive “EMERGENCY” level call from single button activation. The button shall be red in color and shall be clearly marked “EMERGENCY” and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.

b. One (1) “CHECK-IN” call switch that shall activate a distinctive “CHECK-IN” level call from single button activation. The button shall be blue in color and shall be clearly marked “CHECK-IN” and will route the call-in to any one or more Administrative Consoles. This button will be used for emergency check-ins during school emergencies, notifying the front office of the classroom occupants’ safety during an emergency.

I. Equipment Racks

1. All equipment racks shall provide 44 spaces (77”) minimum for mounted system equipment.
2. All equipment racks shall be multi-rack format (“gangable”) style, bolted together, and open cavity.
3. All equipment racks will be provided with lockable rear doors.
4. Equipment rack(s) shall be located in climate-controlled areas/rooms as shown on drawings.
5. All head-end, distribution, and source equipment, including data and power, shall be located in racks configured as approved by the Engineer.
6. Rack mounted equipment shall be accessible from front and rear.
7. All unused rack spaces will be covered with appropriate blank/vent panels.

J. Synchronized Clock System

1. Provide complete and satisfactorily operating NTP Synchronized Clock System with analog and/or digital secondary clocks as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated.
2. (NTP) Network Time Protocol is a network standard protocol that assures accurate synchronization to the millisecond of computer clock

times in a network of computers. Based on UTC, NTP synchronizes client workstation clocks to the U.S. Naval Observatory Master Clocks in Washington, DC and Colorado Springs, CO. Running as a continuous background client program on a computer, NTP sends periodic time requests to servers, obtaining server time stamps and using them to adjust computer clocks.

3. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features.
4. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information.
5. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
6. The NTP Synchronized System consists of a wired NTP receiver connected to a time server. Wired analog and digital clocks are synchronized to the NTP time. System shall synchronize all clocks to each other. System shall utilize NTP technology to provide atomic time to components.
7. System shall not require hard wiring for its components except for AC Power.
8. Analog Clocks shall synchronize to +/- 1 second of the transmitter displayed time.
9. Clocks shall automatically adjust for Daylight Saving per settings on the transmitter
10. The system shall have an internal clock that is continually updated by the NTP receiver. If a NTP failure were to occur, the clocks would continue to be synchronized to the internal clock and would not deviate from each other. Once NTP time is restored, all clocks would once again be synchronized to the NTP time.
11. The system must have a failsafe design so that if a power interruption were to occur, the clocks will continue to operate. If a sync signal is not received by the analog clocks for 48 hours, the second hand will double pulse to indicate this condition. Upon restoration of power, the transmitter will once again communicate with the clocks and normal operation will resume.
12. System shall be 100% programmable from the front operational panel with lights that indicate power status and NTP reception. Panel programming will also include Time Zone, Frequency, 12 or 24 hour operation and DST on/off.
13. The system may be modified to use GPS instead of NTP as the time source without the need to replace the transmitter. A GPS receiver would need to be added with access to the outside of the building.

K. Interior Ceiling Speakers

1. Provide Ceiling Speaker Assembly consisting of 8 Ohm, 8" speaker mounted in a 2 foot by 2 foot, or 2 foot by 1 foot, lay-in baffle, with an integrated back box that covers the full area of the baffle.

2. The speaker shall be connected by inserting an 8-pin RJ45 terminated CAT 5e or Cat 6 cable.
3. The speaker shall include provisions to allow attachment of a safety cable if required.

L. Wall Mounted Horns

1. Provide double re-entrant type horn loudspeakers with integral driver. The horn loudspeaker shall be impervious to weather and vandalism. Horn shall be constructed of heavy-duty ABS plastic. Horn loudspeaker drivers shall be rated at 15 watts with a frequency response of 480 Hz to 14 KHz. Sensitivity shall be 106 dB 1 watt, 1 meter. Transformer assembly shall be dual voltage multi-tap type suitable for 25 or 70-volt installations. Dispersion pattern shall be 180 degrees conical. The horn loudspeaker shall be constructed of treated heavy gauge aluminum, with all exposed parts potted and a sealed driver. Wiring terminal shall be fully enclosed. The speaker flange and mounting surface shall have a cork-rubber gasket. The horn loudspeakers finish shall be gray baked on enamel.
2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The back box shall be 10-3/4”x10-3/4”x6” deep.
3. The baffle shall be vandal proof, the faceplate constructed of 14-gauge carbon steel with a minimum tensile strength of 55,000 PSI. A lattice grid sub-plate shall deny access to the horn but be acoustically transparent for sound projection. Provide tamper proof, stainless steel mounting hardware. The baffle shall a mar/scratch baked epoxy rust inhibitive finish.

M. Uninterruptible Power Supplies (UPS)

1. UPS equipment provided for this system will include Power Conditioning to smooth current and voltage fluctuations.
2. UPS equipment will be sized in accordance with the system manufacturer’s recommendations.
3. Provide an individual UPS for EACH SYSTEM CONTROLLER (Gateway) furnished with the system.
4. Provide additional UPS(s) for protection of all other equipment furnished with the system and housed in the equipment racks.
5. All UPS equipment shall be rack mounted.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Furnish and install all material, devices, components and equipment for a complete operational system.

C. Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

E. All housings are to be located as indicated.

F. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.

H. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.

I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

J. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.3 GROUNDING

A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns,

noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

C. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.5 FINAL ACCEPTANCE TESTING

A. The Final Acceptance Testing shall be provided to the Owner or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner’s Representative establishing the “In Warranty” date. The warranty period will not commence until the Final Acceptance Test is completed.

C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.6 COMMISSIONING

A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.

B. Schedule training with Owner through the owners representative, with at least seven days advance notice.

3.7 OCCUPANCY ADJUSTMENTS

A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

3.8 CLEANING AND PROTECTION

A. Prior to final acceptance, the contractor shall vacuum, wipe down and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked and all cabinet keys will be turned over to the owner or designated owner's representative.

END OF SECTION

SECTION 275313 - WIRELESS CLOCK SYSTEM

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. All bids shall be based on the equipment as specified herein. The catalog numbers and model designations are that of the RAULAND-BORG CORPORATION. The specifying authority must approve any alternate system.

B. Bidders wishing to submit alternate equipment shall submit to the specifying authority, at least 10 days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications. Bidder shall provide adequate information prior to bid date such as specification sheets, working drawings, shop drawings, and a demonstration of the system.

C. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system at the contractor's expense.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 08 00: Commissioning of Communications.
4. 27 15 00: Communications Horizontal Cabling.
5. Applicable Division 26 requirements for power and raceway coordination.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 SUMMARY

A. This Section includes a NTP Synchronized Wireless Clock System. It includes requirements for a NTP Synchronization system components including, but not limited to, the following:

1. Transmitter
2. NTP Receiver module
3. Wireless Analog Clocks (Battery/AC Powered)
4. Wireless Digital Clocks (AC Powered)

1.4 RELATED SECTIONS:

A. The following Division 16 Section may contain requirements that relate to this Section:

1. "Electrical Boxes and Fittings," for boxes, cabinets and fittings used for installation of transmitter for system
2. Intercom/Public Address for interface to bell system

1.5 SYSTEM DESCRIPTION

A. Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating NTP Synchronized Wireless Clock system.

1.6 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Submit equipment drawings with precise locations of transmitter, NTP receiver and all locations of clocks.
2. Submit product data sheets on each component, describing its operational and physical characteristics along with method of installation.
3. The system must operate in accordance with a “Radio Station Authorization” form FCC 601 granted by the Federal Communication Commission (FCC). Submit evidence of application for operating license prior to installing equipment. Furnish the license, or if the license has not been received, a copy of the application for the license, to the Owner prior to operating of the equipment. Upon receipt of license, deliver original license to owner.
4. Provide complete installation, set-up and maintenance instructions and submit a certificate of completion of installation and service training.

1.7 QUALITY ASSURANCE

A. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

B. The manufacturer must be a company specializing in the manufacturer of commercial timekeeping products with a minimum 30 continuous years of documented experience.

C. The contractor shall be an established electronics contractor that has had and currently maintains a locally run and operated business for at least 10 years. The contractor shall utilize a duly authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.

D. The contractor shall show satisfactory evidence, upon request, that the supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

E. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code" including, but not limited to:

1. Article 250, Grounding.
2. Article 300, Part A. Wiring Method.
3. Article 310, Conductors for General Wiring.
4. Article 725, Remote Control, Signaling Circuits.

5. EIA Compliance: Comply with the following Electronics Industries Association Standards:

6. Racks, Panels, and Associated Equipment, EIA-310-A.

F. Installation and start up of all systems shall be under the direct supervision of a local agency regularly engaged in installation, repair, and maintenance of such systems. The supplier shall be accredited by the proposed equipment manufacturers and be prepared to offer a service contract for system maintenance.

G. Contractor providing equipment shall be responsible for providing all specified equipment and mentioned services for all equipment as specified herein. Contractor must be a local authorized distributor of all specified equipment for single source of responsibility and shall provide documents proving such. Contractor must provide written proof that they are adequately staffed with factory-trained technicians for all of the specified equipment. Contractor must have established business for and currently be providing all services for the equipment to be provided for a minimum of 5 years.

H. The contractor shall guarantee availability of local service by factory-trained personnel of all specified equipment from an authorized distributor of all equipment specified under this section. On-the-premise maintenance shall be provided at no cost to the purchaser for a period of one (1) year (parts and labor) from date of acceptance unless damage or failure is caused by misuse, abuse, neglect, or accident. Additionally, all manufacturer supplied products must be covered by a five (5) year (parts only) limited warranty from the date of acceptance. The warranty period shall begin on the date of acceptance by the owner/engineer.

I. The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

J. The supplier shall visit the sites and familiarize himself with the existing conditions and field requirements prior to submitting a proposal.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in factory containers. Store products in a clean and dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.9 IN-SERVICE TRAINING

A. The contractor shall provide a minimum of 2 hours of in-service training with this system. Operators Manuals shall be provided at the time of this training.

1.10 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide a Rauland Telecenter U clock, bell, and paging system by Rauland, or an approved equivalent only where accepted by the Owner and Engineer prior to bid.

1. Telecenter manufactured by Rauland

a. Authorized Rauland Distributor contact:
(1) Jeff Bowers
Innovative Communications Systems, Inc.

775-825-2011

jbowers@innovativecomsys.com

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide one of the following systems:

1. Synchronized Wireless Clock System and secondary clocks manufactured by Rauland-Borg Corp.

B. The intent of this specification is to establish a standard of quality, function and features. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications.

C. The functions and features specified are vital to the operation of this facility, therefore, the acceptance of alternate manufacturers does not release contractor from strict compliance with the requirements of this specification.

D. Any proposed system that operates on an unlicensed frequency or has the FCC license in the name of someone other than the building owner will not be accepted.

E. The Contractor for this work shall be held to have read all the Bidding Requirements, the General Requirements of Division 1, and Contract Proposal Forms; and in the execution of this work, he will be bound by all of the conditions and requirements therein.

F. The contractor shall be responsible for providing a complete functional system including all necessary components whether included in this specification or not.

G. In preparing the bid, the bidder should consider the following:

1. No claim will be made against the owner for any costs incurred by the bidder for any equipment demonstrations which the owner requests.

H. Any prior approval of an alternate system does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with the operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.

I. Alternate equipment shall be considered if submitted to the specifying authority at least ten (10) days prior to bid date. Submission of an alternate shall contain engineering drawings of the system with specification sheets covering all components of the system as well as all items of Section 1 "SUBMITTALS." The system and equipment drawings and specifications sheet shall meet all items of the specification.

J. The specifying authority must approve any alternate supplier.

2.2 SYSTEM REQUIREMENTS

A. GENERAL:

1. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features.

2. Provide complete and satisfactorily operating NTP Synchronized Wireless Clock System with analog and/or digital secondary clocks as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated.
3. (NTP) Network Time Protocol is a network standard protocol that assures accurate synchronization to the millisecond of computer clock times in a network of computers. Based on UTC, NTP synchronizes client workstation clocks to the U.S. Naval Observatory Master Clocks in Washington, DC and Colorado Springs, CO. Running as a continuous background client program on a computer, NTP sends periodic time requests to servers, obtaining server time stamps and using them to adjust computer clocks.
4. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information.
5. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

B. SYSTEM DESCRIPTION AND OPERATION

1. The NTP Synchronized Wireless System consists of a master transmitter located on the inside of the building, and a NTP receiver connected to a time server. An unlimited number of wireless analog and digital clocks are synchronized to the NTP time.
2. System shall synchronize all clocks to each other. System shall utilize NTP technology to provide atomic time to components.
3. System shall not require hard wiring for its components except for AC Power. Analog Clocks may be battery operated for full portability if required.
4. Analog Clocks shall synchronize to +/- 1 second of the transmitter displayed time.
5. Clocks shall automatically adjust for Daylight Saving per settings on the transmitter
6. The system shall have an internal clock that is continually updated by the NTP receiver. If a NTP failure were to occur, the clocks would continue to be synchronized to the internal clock and would not deviate from each other. Once NTP time is restored, all clocks would once again be synchronized to the NTP time.
7. The system must have a failsafe design so that if a power interruption were to occur, the clocks will continue to operate. If a synch signal is not received by the analog clocks for 48 hours, the second hand will double pulse to indicate this condition. Upon restoration of power, the transmitter will once again communicate with the clocks and normal operation will resume.
8. Battery Powered Analog Clocks shall require 2 "D" cell batteries.
9. System shall be 100% programmable from the front operational panel with lights that indicate power status and NTP reception. Panel programming will also include Time Zone, Frequency, 12 or 24 hour operation and DST on/off.
10. The wireless backbone must support expansion of the system to include wireless alphanumeric displays for emergency crisis communications.

C. The system may be modified to use GPS instead of NTP as the time source without the need to replace the transmitter. A GPS receiver would need to be added with access to the outside of the building.

D. The system shall lend itself to expansion by simple addition of wireless secondary clocks and their required power source.

2.3 EQUIPMENT AND MATERIALS

A. WIRELESS TRANSMITTER

1. Rauland Model # WCXATRAN

a. FCC Part 90 Approved, 467.2125-467.4375 MHz frequency range
b. Radio Technology (Narrowband FM, 12.5 KHz bandwidth)
c. 10 selectively available channels
d. 5 watt transmitter
e. Daylight Savings Time pre-programmed
f. Time Zone Pre-set
g. Non-Volatile Memory
h. LCD Display for time, date, year, power, time zone and signal reception
i. Operating Range (32 degrees F to 158 degrees F)
j. Rack or Shelf Mount
k. Power Supply Input: 120-volt AC, Output: 12-volt DC, 3 Amps
l. 7” Rear Mounted Antenna
m. Dimensions: 12”L x 6”W x 1.75”H Weight: 2 lbs
n. NTP Receiver Model # WCXRVRNTP
o. Optional External Antenna
p. For use in large campus applications. Up to 2 miles radius

B. SECONDARY 13” ANALOG CLOCK

1. Rauland Model # WCA1312B

a. 13” Analog Clock (Battery Powered using 2”D” Cell batteries).
b. Maintenance Free.
c. Five year manufacturer’s warranty.
d. Microprocessor based with built-in wireless receiver
e. Heavy Duty Construction
f. Durable ABS Casing
g. Clock numbering graphics shall be Standard Arabic Format (12HR-60 Minute)
h. Face of clock is white
i. Hour and Minute hands shall be black, second hand is red
j. The clock lens shall use a shatterproof polycarbonate material with no visible molding marks. Glass and/or visible molding marks are unacceptable.
k. The clock shall have a low–profile, semi–flush design
l. Wire Guard Model #WCANA13WG in areas where protection is required as indicated on drawings or by owner.

C. SECONDARY 16” ANALOG CLOCK

1. Rauland Model # WCA1612B

a. 16” Analog Clock (Battery Powered using 2”D” Cell batteries).
b. Maintenance Free.
c. Five year manufacturer’s warranty.
d. Microprocessor based with built-in wireless receiver
e. Heavy Duty Construction
f. Durable ABS Casing
g. Clock numbering graphics shall be Standard Arabic Format (12HR-60 Minute)
h. Face of clock is white
i. Hour and Minute hands shall be black, second hand is red

j. The clock lens shall use a shatterproof polycarbonate material with no visible molding marks. Glass and/or visible molding marks are unacceptable.
k. Wire Guard Model #WANA16WG in areas where protection is required as indicated on drawings or by owner.
l. The clock shall have a low–profile, semi–flush design

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the NTP Synchronized Wireless Clock system.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Wiring Methods:

1. Install cabling concealed in conduit or above accessible ceilings. No exposed cabling is permitted except within telecom rooms. Provide plenum-rated cabling. Install Cat 6 cabling for paging system IP devices in accordance with Division 27 requirements, and terminate, label, test, and certify cabling as indicated on the Drawings. Provide 18/2 plenum speaker cable, 18/2 plenum 24VAC power conductors, patch cords, and miscellaneous cabling required for a complete system.

C. Control Circuit Wiring:

1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
2. All housings are to be located as specified and shown on drawings.
3. Make installation in strict accordance with approved manufacturer's drawings and instructions.
4. The contractor shall provide necessary transient protection on the AC power feed. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

D. Weatherproofing:

1. Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

E. Repairs:

1. Wherever walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.

3.3 GROUNDING

A. Provide equipment grounding connections for NTP Synchronized Wireless Clock systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

C. The contractor shall provide all necessary transient protection on the AC power feed leaving or entering the building.

D. The contractor shall note in his system drawings, the type and location of these protection devices as well as all wiring information.

E. The contractor shall furnish and install a dedicated, isolated earth ground from the central equipment rack and bond to the incoming electrical service ground buss bar.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection:

1. Make observations to verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Provide a list of final Atomic Clock Synchronized Master Clock system configuration.

C. Testing:

1. Test, commission, and demonstrate the complete clock, bell, and paging system at project completion. Testing and commissioning shall include verifying installation and support of all speakers and clocks, confirming speaker zones and tap settings, verifying rack-mounted equipment, confirming programming of paging zones, bell schedules, tones, and volume levels, verifying fire alarm mute interface operation, confirming integration with the existing Telecenter V system, and correcting deficiencies before acceptance.

3.5 COMMISSIONING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, programming, and preventative maintenance of the clock, bell, and paging system. Provide a minimum of 2 hours of training. Provide operator manuals, user guides, system documentation, and electronic operation and maintenance manuals at the time of training.

B. Schedule training with Owner through the Architect, with at least seven days advance notice.

3.6 OCCUPANCY ADJUSTMENTS:

A. When requested by the Architect within one year of date of Substantial Completion, provide on-site assistance in adjusting NTP Synchronized Wireless Clock system and adjusting controls to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.7 CLEANING AND PROTECTION

A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION 275313

SECTION 280000 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Include all labor, materials, tools, transportation, storage costs, excavation, training, equipment, insurance, temporary protection, permits, inspections, taxes and all necessary and related items required to provide complete and operational electronic safety and security systems as shown on the Drawings and described in the Specifications.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 05 00: Conductors and Cables for Electronic Safety & Security.
2. Section 28 05 26: Grounding and Bonding for Electronic Safety & Security.
3. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
4. Section 28 05 53: Identification for Electronic Safety & Security.
5. Section 28 20 00: Video Surveillance.
6. Section 28 30 00: Security Detection, Alarm & Monitoring.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 QUALITY ASSURANCE

A. The Contractor installing the Electronic Safety and Security systems shall have a minimum of (5) years experience installing commercial security systems of similar size and scope.

B. See individual Division 28 specifications for additional requirements.

1.4 REGULATIONS AND CODE COMPLIANCE

A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and Local applicable codes and ordinances.

B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

C. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations as well as federal, state and local governmental agencies, including, but not limited to the following:

1. NFPA-70, 2023 - National Electrical Code (NEC).

2. Underwriters Laboratories (UL):

a. UL 50 - Enclosures for Electrical Equipment.
b. UL 294 – Access Control Systems
c. UL 365 – Police Station Connected Burglar Alarm Units and Systems
d. UL 609 – Local Burglar Alarm Units and Systems
e. UL 611 – Central Station Burglar-Alarm Units
f. UL 636 – Hold up alarms
g. UL 1076 – Proprietary Burglar Alarm Units and Systems
h. UL 1610 – Central Station Burglar-Alarm Units
i. UL 60950-1 - Information Technology Equipment - Safety.

3. Federal Communications Commission (FCC):

j. Code of Federal Regulations Title 47 - Part 15 – Radio Frequency Devices.
k. Code of Federal Regulations Title 47 - Part 68 – Connection of Terminal Equipment to the Telephone Network.

4. Americans with Disabilities Act (ADA).

1.5 DEFINITIONS

A.	Accessible Ceiling	Space above a ceiling constructed of removable tiles (clipped or unclipped). Acoustical ceiling grid with removal tiles would be considered an accessible ceiling. A gypboard ceiling would not be considered an accessible ceiling.
B.	Approved/Approval	Written permission to use a material or system.
D.	As Called For	Materials, equipment including the execution specified/shown in the Specifications.
D.	Code Requirements	Minimum requirements.
E.	Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
F.	Exposed	Work not identified as concealed.
G.	Final Acceptance	Owner acceptance of the project from the Contractor upon certification by the Owner's Representative.
H	Furnish	Supply and deliver to installation location.
I.	Furnished by Others	Receive delivery at job site or where called for and install.
J.	Inspection	Visual observations by Owner or Owner's Representative.
K.	Install	Mount and connect equipment and associated materials ready for use.

L.	Listed	Refers to classification by a standards agency.
M.	Or Approved Equal	Approved equal or equivalent as determined by Owner or Owner's Representative.
N.	Owner's Representative	Design professional or Consultant representing the Owner.
O.	Provide	Furnish, install and connect ready for use.
P.	Relocate	Disassemble, disconnect, and transport equipment to new locations: then clean, test, and install ready for use.
Q.	Replace	Remove and provide new item.
R.	Review	A general contractual conformance check of specified products.
S.	Satisfactory	As specified in Specifications.

1.6 INTENT OF DRAWINGS

A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner's Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy

B. Items mentioned in the Specifications and not shown in the Drawings or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner's Representative shall govern.

C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.

D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.7 REVIEW OF SPECIFICATIONS

A. The Contractor shall carefully study and compare the Drawings and Specifications. Any error, inconsistency or omission discovered shall be immediately reported to the Owner or Owner's Representative. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.

1.8 EXAMINATION OF THE PREMISES

A. The Contractor shall visit the Site to become familiar with the local conditions under which the work is to be performed and correlate the observations with the requirements

of the Drawings and Specifications. No allowance will be made for claims of concealed conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.

B. Before ordering any materials or performing any work, the Contractor shall coordinate the installation with the work of other trades and shall verify all measurements. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.9 COORDINATION OF CABLING PATHWAYS AND EQUIPMENT ROOMS

A. Drawings are diagrammatic in depicting the routing of security cabling pathways and the layout of security equipment.

B. The contractor shall coordinate the installation of all work with other trades including Mechanical, Electrical, Plumbing, Sprinkler, Structural and Architectural.

C. The contractor shall participate in coordination meetings with other trades prior to the installation of the work. For a specific space/area, the security contractor shall coordinate the routing and installation of all work with all other trades that have work in that specific space/area.

D. Prior to the installation of security cabling pathway including conduit, sleeves, etc., the contractor shall coordinate the routing of this pathway to avoid conflicts with and provide necessary clearances from the work of other trades. The contractor shall provide all horizontal offsets, vertical offsets and radius bends as necessary to coordinate the routing of the security pathways with the work of other trades and building structure.

E. Prior to the installation of equipment and/or cabling in the communication rooms, the contractor shall coordinate the layout of all equipment and cable pathways with the Telecom Contractor.

1.10 WARRANTY AND SERVICES

A. See individual Division 28 Specifications for warranty requirements.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. Electrical equipment and systems shall meet UL Standards and requirements of the National Electric Code. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the Specifications shall be performed in accordance with these requirements.

B. Equipment shall meet all applicable FCC Regulations.

C. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.

D. The listing of a manufacturer as "acceptable" does not indicate acceptance of a standard or cataloged item of equipment. All equipment and systems must conform to the Specifications.

2.2 WORKMANSHIP, SUBSTITUTIONS, WARRANTY

A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for a minimum of one (1) year from the date of final acceptance. Cable integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed free from defects, transpositions, open shorts, tight kinks, damaged jacket insulation, etc.

B. All labor must be thoroughly competent, skilled and trained, and all work shall be executed in strict accordance with the best practice of the trades.

C. The Contractor shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, improper installation or poor workmanship.

D. After the Contract is awarded, requests to substitute for specified materials shall be submitted by the Contractor to the Owner or Owner's Representative within thirty (30) days, complete with reasons for the substitution and savings which accrue to the Owner if the substitutions are approved. Substitutions after Contract award will be considered only if the substitutions are equal or superior to the products specified.

E. No material substitutions will be allowed except by written acceptance from the Consultant. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples are provided.

F. Approval of alternate or substitute equipment or material in no way voids the Specification requirements.

G. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submit to the Owner or Owner's Representative all evidence to support the contention that the item proposed for substitution is equal to the specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.

2.3 FACTORY ASSEMBLED PRODUCTS

A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit need not be products of the same manufacturer.
2. Component parts, which are alike, shall be from a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Components of equipment shall bear the manufacturer's name or trademark model number and serial number on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

B. Major items of equipment that serve the same function must be the same make and model.

C. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.

D. Maximum standardization of components shall be provided to reduce spare part requirements.

PART 3 – EXECUTION

3.1 ROUGH-IN

A. Before construction work commences, the Contractor shall visit the site and identify the exact routing of horizontal and backbone cable pathways.

B. All equipment locations and cabling pathway shall be coordinated with other trades and existing conditions to eliminate interference with required clearances for equipment maintenance and inspections.

C. Coordinate work with other trades and existing conditions to determine exact location of equipment and routing of cable pathways.

1. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. If, after installation of any equipment, piping, ducts, conduit, etc., it is determined that adequate space has not been provided for passage or maintenance, rearrange the work. Any changes in the size or location of the material or equipment supplied or proposed, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

D. Provide easy, safe and code mandated clearances at equipment racks and enclosures.

3.2 CUTTING, CORING AND PATCHING

A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the security cabling pathway system.

B. Protect existing finishes from water damage during core/cutting work and cleanup all related water and debris. Patch adjacent work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.

C. Contractor to submit all proposed concrete wall or floor penetrations to the Structural Engineer for approval prior to performing the work. Contractor shall locate and avoid cutting concrete reinforcing steel using current x-ray or pachometer equipment.

3.3 FIRESTOPPING

A. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

B. Firestopping assemblies shall meet or exceed the rating of the wall or floor being penetrated.

C. Fire stopping References:

1. ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.
2. ASTM E 119, Fire Tests of Building Construction and Materials (for fire-rated architectural barriers).
3. current NFPA edition adopted by the AHJ National Electrical Code, Section 800-52, Paragraph 2(b), Spread of Fire and Products of Combustion.

3.4 CONCEALMENT

A. Security cabling pathways including conduit, sleeves and tray shall be concealed above ceilings, in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, or in areas without ceilings, the Owner's Representative shall be notified of the proposed routing prior to starting that portion of the work.

B. All CAT 6 security cabling must be routed concealed above accessible ceilings or in conduit. No exposed security cabling is permitted with the exception of CAT 6 security cabling routed within the telecom rooms.

C. All intrusion detection system cabling must be routed in conduit from the field devices to the controllers located in the telecom rooms.

3.5 CONDUIT SEALING

A. All penetrations through slab-on-grade and concrete-filled metal decks to be sealed watertight. See Section 07 92 00 – Joint Sealants.

3.6 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

B. Where mounting heights are not dimensioned, install systems, materials and equipment to provide the maximum headroom possible.

C. Set all equipment to accurate line and grade, level all equipment and align all equipment components.

D. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises.

E. No equipment shall be hidden or covered up prior to inspection by the Owner's Representative. All work that is determined to be unsatisfactory shall be corrected immediately.

F. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

G. The Contractor shall replace all ceiling tiles damaged by work performed as part of the communications contract.

H. Storage and security of material and equipment shall be the responsibility of the Contractor.

END OF SECTION 280000

SECTION 280500 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, tools, transportation, storage costs, testing, training and related items required to provide a complete and operational video surveillance cabling and rough-in system, together with access control and intrusion detection rough-in only where shown on the Drawings and described in the Specifications. Active access control and intrusion detection head-end equipment, controllers, readers, detection devices, programming, licensing and final system commissioning are excluded unless specifically indicated otherwise.

B. Provide video surveillance Category 6 cabling, terminations, patch cords, camera mounting raceway and related rough-in as shown on the Drawings. Provide access control and intrusion detection conduit, backboxes, device rough-in, pathways and pull strings only where shown on the Drawings; do not include active access control or intrusion detection devices unless specifically scheduled or detailed as contractor-furnished.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 00 00: Common Work Results for Electronic Safety & Security.
2. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
3. Section 28 05 53: Identification for Electronic Safety & Security.
4. Section 28 20 00: Video Surveillance.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.

B. Perform all work in accordance with governing codes, rules and regulations including but not limited to the following:

1. NFPA-70, 2023 - National Electrical Code (NEC).
2. FCC Regulations:
   a. Part 15 – Radio Frequency Devices & Radiation Limits
3. Underwriter's Laboratories (UL): Applicable listing and ratings.
   a. UL 294: Access Control System Units
   b. UL 1076: Proprietary Burglar Alarm Units and Systems
4. Electronic Industry Association (EIA) testing standards

5. American Society for Testing and Materials (ATSM)
6. National Electrical Manufacturers' Association (NEMA)

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data sheets for the following items:

1. Wire and Cable for each system identified in the Division 28 Specifications.

PART 2 - PRODUCTS

2.1 WIRE AND CABLE

A. Install Category 6 cabling to video surveillance cameras and other IP-based security devices shown on the Drawings. Category 6 cabling shall be plenum rated, gray jacket, Belden/CDT 2413 008U1000 or approved equal, and shall be installed, terminated, labeled and tested by the Telecom Contractor in accordance with the Division 27 Specifications and the Horizontal Telecom Cable and Termination Schedule.

B. All non-IP electronic safety and security cabling associated with rough-in shall be routed in conduit from field device locations to the designated telecom room, security panel location, or nearest accessible pathway as shown on the Drawings. No exposed cabling is permitted. Conduit shall be sized so as not to exceed 40 percent fill. Outdoor exposed conduit shall be rigid metal conduit, IMC, or as otherwise indicated on the Drawings; concealed conduit routed in walls or above ceilings shall be EMT.

C. Provide cable type, conductor size, conductor quantity and shielding as recommended by the manufacturer of the equipment.

D. Do not share conduits with fire alarm or electrical systems.

E. Provide required wire and cable sized to allow for voltage drop on long runs and effectively shielded as required to allow the routing of 12 & 24V power and signal cable in the same conduit without interference or signal noise.

F. Cable installed outdoors or in underground conduit shall contain a PVC or Polyethylene jacket, flooded to prevent water intrusion.

G. Acceptable Manufacturers:

1. Belden.
2. Commscope.
3. Honeywell Genesis
4. Tappan.
5. Westpenn.
6. Or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Identify and label all wire and cable clearly with permanent labels in accordance with Division 27 requirements, WCSD-SCS-015, and the cable designation shown on the approved submittals or record drawings. Assign wire or cable designations consistently throughout a given system; each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations.

B. Secure all wire and cable run vertically in conduit for continuous distances greater than thirty (30) feet at the vertical run terminations. Non-coaxial cables shall be secured by screw-flange nylon cable ties or similar approved devices, Thomas and Betts or equal. Symmetrical clamping devices with split, circular or other wire conforming, nonmetallic bushings shall be provided for all other cables.

C. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.

D. Make all connections to screw-type barrier strips on panels and with insulated crimp-type spade lugs when appropriate. Size all lugs properly to assure high electrical integrity, i.e., low resistance connections.

E. Lace, tie or harness wire or cable as required herein, and in accordance with accepted professional practice. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point.

F. Wiring for shielding certain conductors from others or routing in separate raceways, shall be as recommended by the manufacturer's current requirements.

G. All wiring shall be installed in conduit and shall be of the size recommended by the equipment supplier.

H. Provide all necessary tie wires.

I. Follow manufacturers recommended guidelines for installation.

END OF SECTION 28 05 00

SECTION 280526 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

1. Provide all labor, materials, equipment, tools, transportation, storage costs, testing, and all necessary and related items required to provide a complete and operational grounding and bonding system for the Electronic Safety and Security System and related telecommunications/security equipment shown on the Drawings and described in the Specifications, including equipment racks, cabinets, cable runway, wire basket tray, system enclosures, access control/intrusion rough-in enclosures where provided, surveillance equipment raceways, and associated metallic raceway systems.

1.2 RELATED SECTIONS

1. General: Consult all other Sections and the complete ES Tenant Improvements and STEAM / Media Building technology drawing sets, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 27 05 26: Grounding and Bonding for Communications Systems.
2. Section 28 20 00: Video Surveillance.
3. Section 27 51 13: Integrated Audio-Video Systems and Equipment / Clock, Bell, and Paging Systems, as applicable to grounding and bonding of rack-mounted and pathway equipment.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

1. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean the latest edition adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein. Coordinate with ANSI/TIA-607-D grounding and bonding requirements where telecommunications grounding busbars, bonding backbones, racks, cabinets, runway, tray, conduits, and communications equipment are shown on the Drawings.

B. Perform all work in accordance with governing codes, rules and regulations including but not limited to the following:

1. American Society for Testing and Materials (ASTM):

2. B1-07 Standard Specification for Hard-Drawn Copper Wire.
3. B3-07 Standard Specification for Soft or Annealed Copper Wire.
4. B8-04 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. 81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
2. C2-07 National Electrical Safety Code.

D. National Fire Protection Association (NFPA):

1. NFPA-70, current edition adopted by the Authority Having Jursidiction - National Electrical Code (NEC).

E. Underwriters Laboratories, Inc. (UL):

1. 44-05 Thermoset-Insulated Wires and Cables
2. 83-08 Thermoplastic-Insulated Wires and Cables
3. 467-07 Grounding and Bonding Equipment
4. 486A-486B-03 Wire Connectors
5. Telecommunications Industry Association (TIA): ANSI/TIA-607-D, Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data sheets for the following items:

1. Ground Bars.
2. Ground Lugs.
3. Specialty Equipment Grounding Connectors
4. Grounding and Bonding Conductors.

B. Shop Drawings: Submit shop drawings indicating the following:

1. Include the location of each PBB/TMGB, SBB/TGB, equipment rack/cabinet ground bar, rack and cabinet bonding conductor, cable tray/runway bonding jumper, wire basket tray bonding jumper, metallic raceway bonding jumper, and connection to building steel or electrical panel grounding electrode system. Show conductor sizes, routing, termination details, and coordination with telecom room enlarged plans, rack elevations, and site grounding diagrams.

C. Test Reports: Provide certified test reports of ground resistance.

D. Certifications: Submit the following grounding certifications at the completion of the project:

1. Certification that the materials and installation are in accordance with the drawings and specifications.
2. Certification by the Contractor that the complete installation has been properly installed and tested.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 4 AWG and larger shall be permitted to be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 10 AWG and smaller shall be ASTM B1 solid bare copper wire.

2.2 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).
B. Provide continuity test reports for bonded cable tray/runway sections, wire basket tray sections, equipment racks/cabinets, metallic security raceways, and telecommunications grounding busbar connections shown on the Drawings.

2.3 GROUND CONNECTIONS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Below Grade: Exothermic-welded type connectors.

C. Above Grade:
1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.
5. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
6. Pipe Connectors: Clamp type, sized for pipe.
7. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.
B. Provide listed telecommunications grounding busbars where shown on the Drawings. Provide a 4-inch by 20-inch by 1/4-inch PBB/TMGB at the MDF or primary telecommunications grounding location unless otherwise noted, and 2-inch by 12-inch by 1/4-inch SBB/TGB busbars at secondary telecommunications rooms or IDF locations unless otherwise noted.

2.5 SPLICE CASE GROUND ACCESSORIES

A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 6 AWG insulated ground wire with shield bonding connectors.

PART 3 – EXECUTION

3.1 GENERAL

A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 CORROSION INHIBITORS

A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.4 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 SECURITY EQUIPMENT ROOM GROUNDING

A. Conduit, cable runway, wire basket tray, equipment racks, cabinets, and security system enclosures: Ground and bond metallic systems as follows:

1. Ground metallic service conduit, exterior surveillance raceway, underground telecommunications raceway, and any pipes entering or routed within telecommunications/security rooms at each end using insulated bonding conductors sized as shown on the Drawings, but not smaller than 6 AWG unless otherwise permitted by code.
2. Bond at all intermediate metallic enclosures, boxes, pull boxes, access control/intrusion rough-in enclosures, and across all raceway or tray joints using bonding jumpers sized as shown on the Drawings, but not smaller than 6 AWG where used for telecom/security bonding.
3. Bond each rack and cabinet to the serving telecommunications grounding busbar using a dedicated insulated bonding conductor. Do not daisy-chain rack or cabinet grounding conductors unless specifically shown otherwise.

3.6 WIREWAY GROUNDING

A. Ground and Bond Metallic Wireway Systems as follows:

1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.

2. Install insulated bonding jumpers between the cable tray/wireway system and the closest telecommunications grounding busbar or building grounding connection at each end and at intervals required by the Drawings and applicable standards.
3. Bond wire basket tray sections together to provide continuous electrical continuity. Where the ES Tenant Improvements drawings specifically require #6 bonding jumpers between sections of tray and bonding to the telecom ground bar, provide #6 green insulated bonding conductors unless a larger conductor is required by code or the Drawings.
4. For the STEAM / Media Building telecom room, provide #6 AWG green insulated bonding conductors to equipment cabinets and ladder rack, #6 bonding straps between ladder rack sections, #2 AWG grounding conductors to building steel and electrical panel grounding points, and the 3/0 AWG telecommunications bonding backbone where shown on the grounding diagram.

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

B. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance.

END OF SECTION 280526

SECTION 28 05 28 - CONDUITS AND BACK BOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, tools, transportation, storage costs, testing, training and all necessary and related items required to provide a complete and operational raceway system for the Access Control, Intrusion Detection and Video Surveillance systems cabling as shown on the Drawings and described in the Specifications.

B. Provide a complete end-to-end raceway system for the Access Control, Intrusion Detection and Video Surveillance systems including conduit, fittings, back boxes, cover plates, j-boxes, pullboxes, fittings, supports, braces, pull string and firestopping.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 00 00: Common Work Results for Electronic Safety & Security.
2. Section 28 05 00: Conductors and Cables for Electronic Safety & Security.
3. Section 28 05 26: Grounding and Bonding for Electronic Safety & Security.
4. Section 28 05 53: Identification for Electronic Safety & Security.
5. ~~Section 28 10 00: Access Control.~~
6. ~~5.~~ Section 28 20 00: Video Surveillance.
7. ~~7.~~6. Section 28 30 00: Security Detection, Alarm and Monitoring.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.

B. Perform all work in accordance with governing codes, rules and regulations including but not limited to the following:

1. National Electrical Manufacturers Association (NEMA):

   a. TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and Tubing
   b. FB1-07 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

2. National Fire Protection Association (NFPA):

   a. 70-11 National Electrical Code (NEC)
   b. D. Underwriters Laboratories, Inc. (UL):

c. 1-05 Flexible Metal Conduit
d. 5-04 Surface Metal Raceway and Fittings
e. 6-07 Rigid Metal Conduit
f. 50-07 Enclosures for Electrical Equipment
g. 360-09 Liquid-Tight Flexible Steel Conduit
h. 467-07 Grounding and Bonding Equipment
i. 514A-04 Metallic Outlet Boxes
j. 514B-04 Fittings for Cable and Conduit
k. 514C-02 Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
l. 651-05 Schedule 40 and 80 Rigid PVC Conduit
m. 651A-07 Type EB and A Rigid PVC Conduit and HDPE Conduit
n. 797-07 Electrical Metallic Tubing
o. 1242-06 Intermediate Metal Conduit

3. ASTM International:

a. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
b. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
c. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
d. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

4. Underwriters Laboratories Inc.:

a. UL 1479 - Fire Tests of Through-Penetration Firestops.
b. UL - Fire Resistance Directory.

1.4 SUBMITTALS

A. See Specification Section 28 00 00 for additional submittal requirements including quantity and format of submittals.

B. Product Data: Submit manufacturer’s product data sheets for the following items:

1. EMT (Electrical Metallic Tubing) Conduit.
2. IMC (Intermediate Metal Conduit)
3. RMC (Rigid Metal Conduit).
4. Schedule 40 PVC.
5. Back boxes.
6. Pull boxes.
7. Hinged cover enclosures and cabinets.
8. Fittings.
9. Firestopping.

C. Shop Drawings: Submit shop drawings indicating the following:

1. Show size and routing of all conduits 2” and larger including the location of pullboxes.
2. Show the size and location of conduit penetrations through fire rated and smoke partitions.

3. Show the size and location of penetrations through structural items including beams, columns and floors. Structural penetrations must be reviewed and approved by the Structural Engineer prior to installing.
4. Show the location of flexible conduit required at expansion joints and seismic joints.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

1.6 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: [ASTM E1966 or] UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

PART 2 – PRODUCTS

2.1 GENERAL

A. Conduit Size: In accordance with the NEC, but not less than 3/4 inch unless otherwise shown.

2.2 CONDUIT

A. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.

B. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.

C. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 volts or less.

D. Flexible galvanized steel conduit: Shall Conform to UL 1.

E. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

F. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

2.3 CONDUIT FITTINGS

A. Rigid steel and IMC conduit fittings:

1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
4. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
5. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

B. Rigid aluminum conduit fittings:

1. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel; Zinc or cadmium plate iron or steel fittings. Locknuts and bushings: As specified for rigid steel and IMC conduit.
2. Set screw fittings: Not permitted for use.

C. Electrical metallic tubing fittings:

1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 2 inches and smaller. Use set screw type couplings with four set screws each for conduit sizes over 2 inches. Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

4. Indent type connectors or couplings are prohibited.
5. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

D. Flexible steel conduit fittings:

1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
2. Clamp type, with insulated throat.

E. Liquid-tight flexible metal conduit fittings:

1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

F. Direct burial plastic conduit fittings:

1. Fittings shall meet the requirements of UL 514C and NEMA TC3.
2. As recommended by the conduit manufacturer.

G. Expansion and deflection couplings:

1. Conform to UL 467 and UL 514B.
2. Accommodate, 0.75 inch deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
3. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
4. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.4 CONDUIT SUPPORTS

A. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.

B. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

C. Multiple conduit (trapeze) hangers: Not less than 1-1/2 by 1-1/2 inch, 12 gage steel, cold formed, lipped channels; with not less than 3/8 inch diameter steel hanger rods.

D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

2.5 OUTLET, JUNCTION, AND PULL BOXES

A. UL-50 and UL-514A.

B. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.

E. Sheet metal boxes: Galvanized steel, except where otherwise shown.

F. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

2.6 CABINETS

A. NEMA 250, Type 1 or 4, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

B. Hinged door in front cover with flush latch and concealed hinge.

C. Key latch to match panelboards.

D. Metal barriers to separate wiring of different systems and voltage.

E. Accessory feet where required for freestanding equipment.

2.7 WIREWAYS

A. Equip with hinged covers, except where removable covers are shown.

2.8 WARNING TAPE

A. Standard, 4-Mil polyethylene 3 inches wide tape non-detectable type, red with black letters, and imprinted with “CAUTION BURIED ELECTRONIC SAFETY AND SECURITY CABLE BELOW”.

2.9 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 2 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.10 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

2.11 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. 3M fire Protection Products.
3. Specified Technology, Inc.
4. Or Approved Equal.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: Dark gray.

2.12 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 – EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Owner prior to drilling, cutting or coring through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Owner required by limited working space.

B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

3.2 INSTALLATION, GENERAL

A. Install conduit as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically continuous.
6. Independently support conduit at 8 foot on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 12 inches of changes of direction, and within 12 inches of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
10. Do not use aluminum conduits in wet locations.
11. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

B. Conduit Bends:

1. Make bends with standard conduit bending machines.

2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

C. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors 600 volts and below:

a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.

2. Align and run conduit parallel or perpendicular to the building lines.
3. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors 600 volts and below:

1. Rigid steel, IMC, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.

C. Align and run conduit parallel or perpendicular to the building lines.

D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

E. Support horizontal or vertical runs at not over eight foot intervals.

F. Surface metal raceways: Use only where shown.

G. Painting:

1. Refer to division 09.

3.5 EXPANSION JOINTS

A. Conduits 3 inches and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 3 inches with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 inch vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 15 inches and larger conduits are acceptable.

C. Install expansion and deflection couplings where shown.

D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

3.6 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

C. Maximum distance between supports is 8 foot on center.

D. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 pounds. Attach each conduit with U-bolts or other approved fasteners.

E. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

F. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.

2. Existing Construction:

a. Steel expansion anchors not less than 1/4 inch bolt size and not less than 1-1/8 inch embedment.
b. Power set fasteners not less than 1/4 inch diameter with depth of penetration not less than 3 inches.
c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

G. Hollow Masonry: Toggle bolts are permitted.

H. Bolts supported only by plaster or gypsum wallboard are not acceptable.

I. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

J. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

K. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

L. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.

M. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.7 BOX INSTALLATION

A. Boxes for Concealed Conduits:

1. Flush mounted.
2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 24 inch, center-to-center lateral spacing shall be maintained between boxes).

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 inches square by 2-1/8 inches deep, with device covers for the wall material and thickness involved.

F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

G. On all Branch Circuit junction box covers, identify the circuits with black marker.

3.8 ELECTRONIC SAFETY AND SECURITY CONDUIT

A. Contractor shall design and install a complete end-to-end raceway system for the entire Door Access Control and Intrusion Detection Systems.

B. Minimum conduit size of 3/4 inch, but not less than the size shown on the drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. All four inch conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 3 inches below the floor and not less than 3 inches below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

H. All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
¾	(6)
1	(9)
1-1/4	(14)
1-1/2	(17)
2	(21)
2-1/2	(25)
3	(31)
3-1/2	(36)
4	(45)

J. Furnish and install 3/4 inch thick fire retardant plywood on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 6 inches above the finished floor.

K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

3.9 INSTALLATION – FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

E. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and roof as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
c. Pack void with backing material.
d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

2. Where cable tray, conduit, wireway, and cable penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

F. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition, floor, ceiling and roof opening as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
c. Install type of firestopping material recommended by manufacturer.

2. Install floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at computer rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

END OF SECTION 28 05 28

SECTION 280553 - IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, tools, transportation, storage costs and all necessary and related items required to provide a complete identification system for the Electronic Safety and Security (ESS) Systems including the Access Control, Intrusion Detection and Video Surveillance systems as shown on the Drawings and described in the Specifications.

1.02 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 00 00: Common Work Results for Electronic Safety and Security.
2. Section 28 05 00: Conductors and Cables for Electronic Safety and Security.
3. Section 28 20 00: Video Surveillance.
4. Section 28 30 00: Security Detection, Alarm and Monitoring.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.03 REGULATIONS AND CODE COMPLIANCE

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.

B. Perform all work in accordance with governing codes, rules and regulations including but not limited to the following:

5. National Electric Code (NEC), NFPA 70.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s product data sheets for the following items:

1. Equipment cabinet and equipment enclosure labels.
2. Wire and cable labels.

B. Samples: Submit samples of the following items:

1. Include physical samples of each labeling material.

PART 2 - PRODUCTS

2.01 LABELS

A. Phenolic two tone for exterior mounting on equipment enclosures. White lettering on black background.

2.02 WIRE AND CABLE LABELS

A. Provide self-laminating adhesive laser labels.

B. Labels shall be machine printable with a laser printer.

C. Text Attributes:

1. Black
2. 1/8” high, minimum, or #12 font size
3. Font: Verdana preferred, SansSerif, or Arial acceptable
4. Printable area: 1.0” X .375” and 1.0” X 0.50”.
5. Cable size: 0.16 – 0.32” OD
6. Color: White

D. Manufacturer:

1. Brady wire marking labels WML–211-295 and WML-311-292.
2. Brother.
3. Thomas and Betts.
4. Or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Physically label all of the ESS Systems components including but not limited to the following:

1. Cables:
   a. Label at all termination points.
   b. Label at pullboxes, junction boxes and outlet boxes.
2. Label Access Control and Intrusion Detection System Cabinets.
3. Label Field equipment cabinets.
4. Label equipment within the cabinets and enclosures indicating its function.
5. Label equipment with its IP address (where applicable).
6. Label Terminal blocks.
7. Label Relays.
8. Label Patch panels, and the termination positions within the patch panels.

B. Identify wire and cable clearly with permanent labels wrapped about the full circumference within one (1) inch of each connection. Indicate the number designated on the associated field or shop drawings or run sheet, as applicable. Assign wire or cable designations consistently throughout a given system; i.e., each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Label cables where cable first enters and exits from conduit, junction or distribution boxes; labels shall be located within six (6) inches of the point of exit.

C. Label all equipment mounted in the equipment enclosures indicating its function. This includes servers, switches, controllers, power supplies, batteries, etc.

D. Components, such as racks and patch panels, must be permanently marked with machine-generated labels, according to current practices and as approved by the Owner before installation.

E. Labels shall coincide with device id's use on the record drawings.

F. Equipment Enclosures.

1. Label all Enclosures, alarm monitoring, and powers supply enclosures associated with the security system with an adhesive backed phenolic label. Use 12 point text.
2. Labels shall be represented in and match the security system record drawings.

G. Security Devices.

1. Label all equipment associated with the security system with a permanent machine generated, laminated, label. Use 12 point text with a clear background. Use white or black lettering depending upon the color of the device.
2. Label device in a concealed location with the system point number and address.
3. Label power supply batteries with the month and year they were installed.

H. Wire and Cable.

1. Label all wire and cable associated with the security system with permanent machine generated, laminated, labels. Use 12 point, black text on a white label.
2. All wire and cable labels shall be clearly visible without the need to remove wire management or any other obstructions.

END OF SECTION 280553

SECTION 282000 – VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, tools, transportation, storage costs, testing, training and all necessary and related items required to provide a complete and operational video surveillance system as shown on the Drawings and described in the Specifications.

B. Contractor shall furnish, install, mount, secure, aim, focus, configure, and update firmware for all scheduled IP video surveillance cameras. Contractor shall provide MAC address information and temporary login credentials to WCSD, assign IP addresses provided by WCSD, install patch cords, and cross-connect cameras to WCSD-designated PoE switch ports.

C. Install, mount, secure, aim, focus and adjust all IP video surveillance cameras. Aim cameras as directed by WCSD Project Manager.

D. Install CAT 6 cabling from each camera to patch panels as shown on the drawings. All CAT 6 cabling to be installed and tested in accordance with the Division 27 Specifications.

E. Furnish CAT 6 patch cords at the patch panel to connect the camera patch panel ports to owner furnished POE switches. WCSD Project Manager will provide designated pre-configured POE switch port numbers to the contractor. Contractor shall install patch cords and cross connect the cameras to the designated switch ports.

F. WCSD IT will furnish and install Milestone camera licenses and will provide, install, and configure Milestone recording server software, client viewing software, recording settings, and related VMS software entitlements unless specifically indicated otherwise in the Drawings.

G. WCSD IT will furnish and configure Milestone software.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 00 00: Common Work Results for Electronic Safety & Security.
2. Section 28 05 00: Conductors and Cables for Electronic Safety & Security.
3. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
4. Section 28 05 53: Identification for Electronic Safety & Security.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 QUALITY ASSURANCE

A. The Contractor installing the IP video surveillance cameras and video recording software must have a minimum of (5) years experience installing video surveillance systems of similar size and scope.

B. The Contractor installing the IP video surveillance system must be a firm normally engaged in the design, installation and maintenance of integrated security systems including access control, intrusion detection and video surveillance.

C. The contractor installing the Category 6 cabling to the cameras must comply with the qualification requirements and installation requirements listed in the Division 27 Specifications.

D. The Contractor must be licensed by the Nevada State Contractors Board.

E. Formal, written evidence of the following may be requested at any point during the Bid or installation processes:

1. If requested, the Contractor, including any subcontractor, shall show proven expertise in the implementation of video surveillance projects. This expertise can be illustrated through the inclusion of details of at least three (3) projects involving the design and installation of video surveillance systems within the past three year period of similar size and scope. Names, addresses, and telephone numbers of references for the three projects shall be included.
2. In the event subcontractors are used for any portion of the installation or acceptance testing, the Contractor shall be responsible for any subsequent corrective action required on that portion of the work.

1.4 SUBMITTALS

A. Prior to procurement, the Contractor shall compare this Section against the camera schedule and plan symbols shown in the Drawings. Any discrepancy in camera type, model number, mount accessory, PoE requirement, cable termination, or detail reference shall be submitted as an RFI before ordering equipment.

B. Camera quantities shall be based on the camera schedules and plan locations shown in the Drawings. The Contractor shall verify the total camera count for each building package before procurement and shall notify the Owner or Owner’s Representative of discrepancies between the camera schedule, plan symbols, and this Section.

C. Manufacturer Product Data Sheets

1. Submit product data sheets in electronic PDF (portable document format).
2. Provide a table of contents for each submittal indicating the items being submitted. Products listed in the table of contents should be in the same order as they appear in the Specifications.
3. Provide product data sheets for all items listed in each specification section. Partial submittals will not be accepted.
4. Where product data sheets include more than one distinct item, clearly mark data sheet with arrow or other identifying means to clearly indicate the items being submitted for approval. Delete or cross-out non-applicable data.
5. Provide a camera submittal matrix identifying each scheduled camera number, camera type, manufacturer, model number, mount part number, environment, PoE requirement, serving telecom room, patch panel port, MAC address, IP address assignment, and drawing detail reference.

    a. Indoor fixed vandal resistant dome cameras.
    b. Outdoor fixed vandal resistant dome cameras.

c. Indoor fixed 2-sensor vandal resistant dome cameras.
d. Outdoor fixed 4-sensor vandal resistant dome cameras.
e. Camera supports shall include all wall mount kits, corner mount kits, pole mount kits, gooseneck support arms, ceiling pendant kits, recessed ceiling mounts, back boxes, adapters, shrouds, weatherproof accessories, custom extension arms, fasteners, and miscellaneous hardware required for the scheduled camera type, mounting condition, and detail reference.
f. CAT 6 Cabling – Indoor Plenum Rated.
g. CAT 6A Field Mount Plugs.
h. 48-Port CAT 6A Patch Panels.
i. CAT 6 Patch Cords.

1.5 REGULATIONS AND CODE COMPLIANCE

A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and local applicable codes and ordinances.

B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

C. All work and materials shall conform to and be installed, inspected and tested in accordance with federal, state and local governmental agencies, including, but not limited to the following:

1. ANSI/NFPA-70, current edition adopted by the Authority Having Jurisdiction - National Electrical Code (NEC).
2. Underwriter's Laboratories, Inc. (UL).
3. Federal Communications Commission (FCC).
4. Americans with Disabilities Act (ADA).

1.6 INTENT OF DRAWINGS

A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner's Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy

B. Items mentioned in the Specifications and not shown in the Drawings, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner's Representative shall govern.

C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.

D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.7 REVIEW OF SPECIFICATIONS

A. Prior to submitting a bid for the Project, the Contractor shall carefully study and compare the Drawings and Specifications and shall at once report to the Owner or Owner's Representative any error, inconsistency or omission discovered. During construction, if the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Specifications without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.

B. The Contractor shall not deviate from the specified scope of work as indicated in the Project Documents. Deviations include (but are not limited to):

1. Alteration of video surveillance camera locations from those specified in Plans.
2. Installation of horizontal cables to a different Telecom Room than indicated on the Plans.

1.8 EXAMINATION OF THE PREMISES

A. The Contractor shall visit the Site(s) to become familiar with the local conditions under which the work is to be performed and correlate his observations with the requirements of the Drawings and Specifications. No allowance will be made for claims of concealed conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.

B. Before ordering any materials or performing any work, the Contractor shall verify all measurements and be responsible for correctness of same. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.9 DELIVERY, STORAGE AND HANDLING

A. All items to be installed as a component of the IP video surveillance system for the Project shall be stored according to manufacturer's recommendations. In addition, all items must be stored in a location protected from vandalism and weather. Items shall not be stored outside. If air temperature at the storage location shall be below 40 degrees F, the equipment shall be moved to a heated 50 degrees F (minimum) location. If necessary, equipment shall be stored off site at The Contractor's expense.

1.1 WARRANTY

A. See Division 1 Specifications and General Conditions regarding Guarantee and Warranty requirements which apply to this Specification Section.

B. The Contractor shall provide the following warranty for the Video Surveillance System described in this specification section:

1. Warranty Start Date: The warranty period will begin after substantial completion of the project.

2. Complete System Warranty: The complete Video Surveillance System including all devices, equipment, cabling, software and programming shall be guaranteed to be free from defects in workmanship and materials for a minimum period of one (1) year from date of substantial completion. Promptly remedy such defects and any subsequent damage caused by the defects or repair thereof at no expense to the Owner.

3. Labor Warranty: Contractor to provide all labor as necessary to complete warranty repairs for a period of one (1) year from the date of substantial completion. During this labor warranty period, all services including equipment, labor, travel, expenses, etc., shall be provided during normal working hours at no cost to the Owner. The Contractor shall provide the Owner with a phone number for service. The Contractor shall respond within one (1) business day of receipt of a service call. The Contractor shall provide an on-site response time of two (2) business day for repair of critical system items during normal business hours.

4. Warranty Exclusions: The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.

1.10 FINAL ACCEPTANCE

A. General

1. All cameras mounted in accordance with the drawings.
2. IP address assigned to cameras and temporary login credentials provided to WCSD IT. Contractor to provide camera hardware MAC addresses to WCSD IT and WCSD IT will provide camera IP addresses to be assigned.
3. All CAT 6 cables installed, terminated, labeled and tested. Certified test reports submitted to WCSD.
4. All cameras properly aimed and focused as directed by WCSD IT.
5. All Punchlist items completed.

B. Inspection Of Work

1. WCSD Project Manager shall perform an inspection of all Contractor work prior to final acceptance. Any items that are found to be in error at this time shall be documented.
2. Documentation shall then be provided to the Contractor, who shall provide a date (within 30 days of WCSD Project Manager inspection) by which all items shall be corrected. The Contractor has the option to coordinate a site visit with the WCSD Project Manager in order to clarify and/or dispute the issues.
3. WCSD Project Manager shall perform a re-inspection of all Contractor work. Any remaining or additional items that are found to be in error shall again be documented. WCSD/IT reserves the right at this point to employ a separate contractor to make corrections at a cost to The Contractor.

PART 2 – PRODUCTS

2.1 FIXED INDOOR VANDAL RESISTANT 2 MP AND 4 MP DOME CAMERAS

A. Provide cameras meeting the following requirements:

1. The camera shall be of manufacturer’s official product line, designed for commercial/industrial 24/7/365 use.
2. The camera shall be based upon standard components and proven technology using open and published protocols.
3. 3. Provide fixed indoor vandal-resistant dome cameras as scheduled on the Drawings. Indoor dome camera models shall include Axis M3085-V, Axis M4215-V, and Axis M4216-V as indicated by camera location. Cameras shall provide minimum 2 MP or 4 MP resolution as scheduled, WDR/Lightfinder

performance, H.264/H.265 streaming, PoE operation, onboard analytics support, and vandal-resistant indoor dome construction.
4. RJ-45 Ethernet Connector. 10/100 Base-T.
5. IEEE 802.3af Compliant.
6. Mini-Dome.
7. Auto Zoom and Focus via Web Browser.
8. Vandal Resistant IK10 Rated.
9. H.264 video compression at 30fps.

B. Acceptable Products

1. Camera:
   a. Axis M3085-V, Axis M4215-V, and Axis M4216-V as indicated in the camera schedule and Drawings.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2. Recess ceiling mount.
   a. Provide recess ceiling mount kit where shown on drawings (Axis P/N TP3206-E).
   b. Mounting accessories shall be included with the camera where indicated as “INCLUDED” in the camera schedule. Provide manufacturer-recommended adapters, back boxes, recessed mounting kits, pendant kits, or other accessories required for the scheduled mounting condition.
   c. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2.2 FIXED INDOOR AND OUTDOOR VANDAL RESISTANT 5 MP AND 8 MP DOME CAMERAS

C. Provide cameras meeting the following requirements:

1. The camera shall be of manufacturer’s official product line, designed for commercial/industrial 24/7/365 use.
2. The camera shall be based upon standard components and proven technology using open and published protocols.
3. Minimum resolution shall be 5 MP for Axis P3277-LVE and 8 MP for Axis Q3548-LVE, or as otherwise indicated in the camera schedule and Drawings.
4. RJ-45 Ethernet Connector. 10/100 Base-T.
5. IEEE 802.3af Compliant.
6. Mini-Dome.
7. Auto Zoom and Focus via Web Browser.
8. Vandal Resistant IK10 Rated.
9. H.264 video compression at 30fps.

D. Acceptable Products

1. Camera:
   a. Camera: Axis P3277-LVE with AXIS TP3206-E mount where scheduled, mounting accessories, or other camera model specifically indicated in the Drawings for the camera type and Axis Q3548-LVE with AXIS TQ3601-E mount where scheduled.location.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2.2 FIXED 20 MEGAPIXEL 4-IMAGE SENSOR MULTIDIRECTIONAL VANDAL RESISTANT DOME CAMERAS

a. Provide cameras meeting the following requirements:

1. Camera will consist of 4 individual 5MP fixed cameras installed in a single vandal resistant dome.
2. Each of the 4 cameras within the dome shall be capable of being repositioned within the dome by moving it around the perimeter of a circular support track.
3. Each of the 4 cameras within the dome shall be capable of being independently aimed up and down, side to side.
4. Each of the 4 cameras within the dome shall be capable of being remotely focused and zoomed over the IP network via a web browser.
5. Each of the 4 cameras will have a minimum 5MP 2560x1440 Resolution per sensor.
6. Dual encoder (H.264 and MJPEG).
7. The entire camera assembly will one RJ-45 Ethernet Connector, 10/100 Base-T.
8. The entire camera assembly will require 1 software camera license within the VMS software.
9. Power shall be provided via Power over Ethernet Plus (PoE+), compliant with IEEE 802.3at, as required by the scheduled Axis P3737-PLE multi-sensor camera.
10. Vandal Resistant and IK10 Rated.
11. IP 66 Ingress and Weather Rated.
12. Indoor/Outdoor rated.
13. Video frame rate (up to) 30FPS @ full resolution.
14. Privacy masking.
15. Operating temperature -30˚C (-22 °F) to +50˚C (122 °F).

b. Provide corner mount kit, gooseneck support arm and shroud to mount cameras on exterior corners of buildings as shown on the drawings. Provide additional mounting plates, adapters and accessories as necessary for a vandal resistant and weatherproof installation.

c. Acceptable Products

1. Camera:
   a. Axis P/N P3737-PLE.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2. Pendant Mount:
   a. Provide pendant mount kit where shown on drawings including AXIS TP3302-E and AXIS T94N01D mounting accessories, with custom length 1.5 NPT extension column as required to clear ceiling or canopy obstructions.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

3. Exterior Corner Mount:
   a. Provide exterior corner or wall mounting accessories as scheduled, including AXIS TP3302-E and AXIS T94N01D where indicated. Provide additional brackets, back boxes, adapters, fasteners, and weatherproof accessories required for a secure, vandal-resistant, and weatherproof installation.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

4. Exterior Pole Mount:
    a. Provide pole mount kit where shown on the drawings including stainless steel bands and mount (Axis P/N T91B57), mounting cabinet (Axis P/N T98A18-VE), wall mount arm (Axis P/N T91D61) and camera pendant kit (Axis P/N T94N01D).
    b. Where listed as “INCLUDED” in the camera schedule, provide the manufacturer’s standard mounting accessories and all additional hardware required for the installation condition shown on the Drawings.
    c. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2.2 HORIZONTAL PLENUM RATED CATEGORY 6 CABLE.

A. See Section 271500 for requirements.

2.3 CATEGORY 6A FIELD MOUNT PLUGS

A. See Section 271500 for requirements.

2.4 CATEGORY 6 COPPER PATCH PANELS

d. See Section 271100 for requirements.

2.5 CATEGORY 6 COPPER PATCH CORDS

A. See Section 271100 for requirements.

2.6 VIDEO MANAGEMENT SOFTWARE SYSTEM

a. WCSD IT will provide and install Milestone camera licenses.

b. WCSD IT will provide, install and configure Milestone recording server and client viewing software.

PART 3 – EXECUTION

3.1 CAMERA SYSTEM INSTALLATION SEQUENCE AND COORDINATION WITH WCSD

A. The following is the installation sequence for the camera system. The contractor shall coordinate and schedule all work with WCSD’s Project Manager.

1. Contractor shall procure cameras and provide a spreadsheet to WCSD Project Manager indicating the camera number, MAC address and camera name. The camera numbers shall match the numbers in the camera schedule. WCSD will provide IP addresses for each camera. Contractor shall configure the cameras with the provided IP addresses and shall update all cameras with current manufacturer firmware.
2. Contractor shall provide camera and temporary login credentials to WCSD Project Manager.
3. Contractor shall install, terminate and test cabling to the cameras. Contractor shall provide certified cable test results to WCSD Project Manager and provide patch cords for the cameras. WCSD IT will inspect the cabling installation and will issue a punchlist identifying any corrective action required.

4. After the contractor has completed all punchlist items, WCSD IT will install the POE switches and will provide designated pre-configured POE switch port numbers to the contractor. Contractor shall install patch cords and cross connect the cameras to the designated switch ports.
5. Contractor shall connect, aim, focus and adjust the cameras. Each camera view must be reviewed and signed off by WCSD Project Manager.
6. WCSD IT will complete all remaining Milestone Software configuration including:

    a. Installation of Milestone recording server and software at the project site.
    b. Installation of camera licenses. Camera licenses provided and installed by WCSD IT.
    c. Configuration of camera settings including frame rate, compression, motion detection, privacy masking, recording, etc.
    d. Installation of Milestone Smart Client software on workstation computers at the project site.

3.2 ROUGH-IN

A. Before construction work commences, the Contractor shall visit the site and identify the exact location and mounting of all cameras.

B. Camera mounting locations shall be coordinated with the work of other trades including ductwork, return and supply grills, lights, switches, exit signs, fire sprinklers, smoke detectors and structure. Cameras, mounts, raceway and cabling shall be installed so as not to interfere with required clearances for maintenance and inspection of equipment.

C. Notify the Owner’s Representative of any obstructions that may block the camera views shown on the Drawings.

D. The contractor shall minimize the amount of exposed conduit and boxes exposed to view. Paint all interior and exterior conduit exposed to view to match adjacent surfaces. All exterior conduit shall be rigid RMC with water tight boxes and fittings.

E. All exposed screws and fasteners used for camera mounting hardware, conduit supports, j-boxes and pull boxes shall be vandal resistant (Torx Pin-Head Style).

3.3 CUTTING AND PATCHING

A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the camera installation. Patch adjacent work disturbed or damaged by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.

B. The contractor shall be responsible for repairing any ceiling tile, ceiling grid, ceiling supports or adjacent surfaces damaged during the installation of the cameras.

C. All penetrations through the building envelope shall be sealed and made water tight.

D. All penetrations through fire rated walls, floors and ceilings shall be fire stopped with a UL listed fire stop system meeting or exceeding the rating of the assembly being penetrated.

E. No roof penetrations are permitted. Where cameras, conduits, or mounting supports are located near roof edges, canopies, fascia, or roof hatch areas, route raceway from accessible ceiling or wall locations and coordinate final routing to maintain the building envelope without penetrating the roof assembly.

3.4 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

B. Set all cameras and associated supports to accurate line and grade, level all equipment and align all equipment components.

C. Provide all scaffolding, rigging, hoisting and services necessary for installation of equipment.

D. Storage and security of material and equipment prior to installation shall be the responsibility of the Contractor.

3.5 CEILING DOME CAMERA MOUNTING AND NETWORK CONNECTION

A. Install ceiling mounted dome cameras and support brackets in accordance with the Manufacturer's instructions.

B. Verify ceiling mounted camera locations shown on the drawings. The contractor shall verify that adequate clearances exist above the camera to allow installation at the locations shown. The contractor shall make minor adjustments to the camera locations to avoid clearance conflicts.

C. Secure cameras to structure with mount kit called out in the camera schedule.

D. Furnish, install, and terminate Category 6 cabling from each IP camera to the telecom room or existing MDF location identified on the Drawings. At existing telecom locations, terminate camera cabling on existing 48-port patch panels where indicated and coordinate exact termination locations with WCSD.

E. Terminate CAT 6 cable at the camera on CAT 6A Field Mount Plug and connect directly to the camera.

F. The contractor shall work with the WCSD IT department to cross connect the cameras to the POE switches in the telecom rooms.

G. The contractor shall assign static IP addresses to the camera with the IP address scheme specified by WCSD IT.

H. Verify that the camera has the most current firmware version. If not, download and install the latest firmware version from the manufacturer's website.

3.6 EXTERIOR GOOSENECK CAMERA MOUNTING AND NETWORK CONNECTION

A. Notify the Owner's representative where obstructions exist that may block the view from the camera prior to installing the camera.

B. Install fixed dome cameras, corner mount kits, gooseneck supports and shrouds in accordance with the Manufacturer's instructions.

C. Core drill exterior building and install rigid conduit to feed the camera via the support bracket.

D. For cameras connected to existing surface-mounted junction boxes or existing conduit pathways, reuse existing pathways where indicated on the Drawings, field verify pathway capacity and condition, and provide new conduit, pull boxes, fittings, and watertight accessories as required for a complete installation.

E. Paint exposed conduit to match existing surfaces.

F. Securely anchor corner mount kit and/or gooseneck support bracket to structure.

G. Install camera shroud and connect camera to shroud.

H. Verify that camera and mounts are level and plumb.

I. Verify that all components are secure to prevent vibrating or unstable images caused by wind or vibration.

J. All exposed screws and fasteners shall be vandal resistant (Torx Pin-Head Style).

K. Furnish, install, and terminate Category 6 cabling from each exterior IP camera to the telecom room or existing MDF location identified on the Drawings. At existing telecom locations, terminate camera cabling on existing 48-port patch panels where indicated and coordinate exact termination locations with WCSD.

L. Terminate CAT 6 cable at the camera on CAT 6A Field Mount Plug and connect directly to the camera.

M. The contractor shall coordinate and work with the WCSD IT department to cross connect the cameras to the POE switches in the telecom rooms.

N. The contractor shall assign static IP addresses to the camera with the IP address scheme specified by WCSD IT.

O. Verify that the camera has the most current firmware version. If not, download and install the latest firmware version from the manufacturer’s website.

3.7 FIXED CAMERA SETUP, FOCUSING AND ADJUSTMENT

A. Contractor shall connect, aim, focus, adjust, and assist with analytics configuration for each camera. Final camera orientation, field of view, focus, exposure settings, and analytics configuration shall be reviewed and approved by WCSD prior to system acceptance.

END OF SECTION

SECTION 28 30 00 – SECURITY DETECTION, ALARM AND MONITORING

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes Intrusion Detection System (IDS) head-end control panel, automatic cellular dialer for central station monitoring, controllers, power supplies, batteries, magnetic door position contacts, passive infrared motion detectors, keypads, conduit and back boxes, signal and control wiring, system configuration, programming, testing, demonstration and training.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish and install all equipment, materials, labor, and services necessary to provide a complete and operable intrusion detection system and to insure that the system is in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

B. Provide all equipment, cabling and ancillary items as normally provided for a complete and operational security intrusion detection system.

C. Furnish and install intrusion detection control panel including control panel, lockable enclosure, tamper switch, controllers, relay boards, add-in boards, power supplies, batteries, battery chargers, automatic dialer, etc. Connect panel to phone lines and data network as required.

D. Furnish and install addressable intrusion detection devices including magnetic door position contacts, magnetic rollup door position contacts, magnetic roof hatch position contacts and combination keypad/annunciators.

E. Provide 120VAC power at security panels.

F. Provide automatic cellular dialer for remote central station monitoring. Provide plug-in supervised cellular interface.

G. Prep door frames as necessary to receive intrusion detection devices.

H. Furnish, install, terminate, test and label signal and power cabling for all intrusion detection devices.

I. Furnish and install raceway for access control cabling including conduit and back boxes. All intrusion detection cabling to be routed in conduit from the devices to the control panel located in the telecom room.

J. Perform system testing and commissioning of the entire intrusion detection system including all devices shown on the drawings.

K. Meet with the Owner to determine the required operation, zoning and functionality of the system. Program the security system in accordance with the Owner’s requirements.

L. Demonstrate the entire security system to the Owner at the completion of the project. Provide two (2) hours of training to the admin staff on the system.

1.3 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 00 00: Common Work Results for Electronic Safety & Security.
2. Section 28 05 00: Conductors and Cables for Electronic Safety & Security.
3. Section 28 05 26: Grounding and Bonding for Electronic Safety & Security.
4. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
5. Section 28 05 53: Identification for Electronic Safety & Security.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.4 REGULATIONS AND CODE COMPLIANCE

A. Comply with all applicable governmental regulations including Federal, State, City, and local applicable codes and ordinances. All work shall comply with local building codes, local and State fire marshal regulations and OSHA.

B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

C. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations of the security industry, as well as federal, state and local governmental agencies, including, but not limited to the following

D. Underwriters Laboratories (UL):

1. UL 50 - Enclosures for Electrical Equipment.
2. UL 365 – Police Station Connected Burglar Alarm Units and Systems
3. UL 609 – Local Burglar Alarm Units and Systems
4. UL 611 – Central Station Burglar-Alarm Units
5. UL 636 – Hold up alarms
6. UL 1076 – Proprietary Burglar Alarm Units and Systems
7. UL 1610 – Central Station Burglar-Alarm Units
8. UL 60950-1 - Information Technology Equipment - Safety.

E. Federal Communications Commission (FCC):

1. Code of Federal Regulations Title 47 - Part 15 – Radio Frequency Devices.
2. Code of Federal Regulations Title 47 - Part 68 – Connection of Terminal Equipment to the Telephone Network.

A. ANSI/NFPA-70, 2011 -- National Electrical Code (NEC).

F. Americans with Disabilities Act (ADA).

1.5 QUALITY ASSURANCE

A. The Contractor installing the intrusion detection security system shall have a minimum of (5) years experience installing commercial intrusion detection / burglar alarm systems of similar size and scope.

B. The Contractor installing the intrusion detection system must be a firm normally engaged in the design, installation and maintenance of integrated security systems including intrusion detection, fire alarm and video surveillance.

C. The Contractor must be licensed by the Nevada State Contractors Board.

D. Formal, written evidence of the following may be requested at any point during the Bid or installation processes:

1. If requested, the Contractor, including any subcontractor, shall show proven expertise in the implementation of intrusion detection systems on commercial projects. This expertise can be illustrated through the inclusion of details of at least three (3) projects involving the design and installation of intrusion detection systems within the past three year period of similar size and scope. Names, addresses, and telephone numbers of references for the three projects shall be included.
2. In the event subcontractors are used for any portion of the installation or acceptance testing, the Contractor shall be responsible for any subsequent corrective action required on that portion of the work.

E. Provide new and un-used devices, equipment and cabling. Comply with all manufacturers' installation instructions.

F. All cable, raceways and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative.

G. All work shall be supervised on a daily basis by qualified and competent personnel. The contractor shall keep the same foreman and workman on the job throughout the duration of the project.

H. The manufacturer of the intrusion detection security system equipment shall be certified as being compliant with ISO 9001.

1.6 SUBMITTALS

A. Manufacturer's Data Sheets: Submit manufacturer's data sheets in electronic PDF format for the following items:

1. Intrusion Control Panel, Automatic Cellular Dialer, Zone Expansion Modules, Add-in Boards, Relays.
2. Power Supplies & Battery Chargers.
3. Batteries.
4. Lockable Equipment Enclosures with Tamper Switch.
5. Addressable Magnetic Door Position Contacts.
6. Addressable Magnetic Rollup Door Position Contacts.
7. Addressable Magnetic Roof Hatch Position Contacts.
8. Addressable Passive Infrared Motion Detectors.
9. Touch Screen Keypad/Annunciators.
10. Security System Cabling.
11. Labels.

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

C. Shop Drawings:

1. Submit floor plans indicating the location of all intrusion field devices, control panels and keypads.
2. Provide a spreadsheet for each security device and its ID (point) within the security system.
3. Submit point-to-point wiring diagrams and block diagrams showing all intrusion detection, controllers, power supplies, relays, I/O boards, battery backups, etc.
4. Submit layout drawings of the components mounted in the lockable security enclosures including controllers, dialers, I/O boards, relays, power supplies, battery chargers, batteries, cable management devices, overhead wiring gutters, phone outlets, data outlets, electrical outlets, etc.
5. Submit security panel battery calculations.
6. Drawings shall be submitted in electronic PDF format.

1.7 DELIVERY, STORAGE & HANDLING

A. Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name, equipment model and serial identification numbers, and UL logo.

B. Protect all security panels, devices and cabling from moisture, dust and debris prior to installation.

1.8 COORDINATION

A. Coordinate arrangement, mounting, and support of intrusion detection system equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

1.9 WARRANTY

A. See Division 1 Specifications and General Conditions regarding Guarantee and Warranty requirements which apply to this Specification Section.

B. The Contractor shall provide the following warranty for the Intrusion Detection System described in this specification section:

1. Warranty Start Date: The warranty period will begin after substantial completion of the project.

2. Complete System Warranty: The complete Intrusion Detection System including all devices, equipment, cabling, software and programming shall be guaranteed to be free from defects in workmanship and materials for a minimum period of one (1) year from date of substantial completion. Promptly remedy such defects

and any subsequent damage caused by the defects or repair thereof at no expense to the Owner.

3. Labor Warranty: Contractor to provide all labor as necessary to complete warranty repairs for a period of one (1) year from the date of substantial completion. During this labor warranty period, all services including equipment, labor, travel, expenses, etc., shall be provided during normal working hours at no cost to the Owner. The Contractor shall provide the Owner with a phone number for service. The Contractor shall respond within four (4) business hours of receipt of a service call. The Contractor shall provide an on-site response time of one (1) business day for repair of critical system items during normal business hours.

4. Warranty Exclusions: The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.

5. Routine Site Visits During Warranty Period: Provide one routine maintenance visit at the end of the one (1) year labor warranty period at a time coordinated with the Owner. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

6. Labor Warranty and Maintenance Service Renewal: No later than 60 days prior to the expiration of the one (1) year labor warranty period, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. The Owner will be under no obligation to accept maintenance service proposal.

PART 2 – PRODUCTS

2.1 INTRUSION DETECTION SYSTEM (IDS) MANUFACTURERS

A. Acceptable Manufacturer:

1. Bosch Security Systems.
2. No Substitutions.

2.2 GENERAL DESCRIPTION

A. Control Panel and Features:

1. The Intrusion Detection System (IDS) control panel shall be Bosch Security Systems, Inc. model B9512G comprising a fully integrated intrusion, and fire. The control panel shall support the following:

a. The IDS system is capable of being utilized as a combination Intrusion and Commercial Fire system per code. Fully integrated intrusion and fire functions allow users to interface with 1 system instead of 2
b. Optional Telephone Line Module, programmable for signaling and supervision.
c. Integrated Conettix IP based communication provides high-speed, secure alarm transport and control.
d. 32 programmable areas with perimeter and interior partitioning.
e. 8 on-board, hardwired points with expansion capability for a total of 599 using a combination of wired or wireless points.
f. Compatibility with Color Graphic Touch Screen, 2-line alpha numeric capacitive touch, ATM style LCD or 2-line LCD style Alarm Keypads.

g. Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software (RPS).
h. The system shall include an integrated USB port for local programming and diagnostics using a computer running Remote Programming Software (RPS) and a male USB2.0 to male USB 2.0 cable with no additional hardware modules required.
i. The system shall support the use of an Apple iOS device and/or Android device for control. Functions to include arming, disarming and control of outputs and access door, viewing of connected IP cameras. This application shall connect directly to the IDS using internet, wifi or cellular communications and shall not require a third party server of network operations center (noc).
j. The IDS will allow integration with up to 16 Bosch IP video cameras using the built-in Ethernet connection, allowing the cameras to act as inputs and outputs.
k. The IDS shall support integration with the Bosch Video Management System (BVMS) using the built-in Ethernet adapter.
l. The IDS shall support up to thirty-two (32) custom functions allowing the installer to combine up to 6 functions into one command. These custom functions shall be operated by keypad command, point activation, keyfob button, or programmable schedule
m. The IDS shall support up to 32 keypad shortcuts which allow the installer to define which commands are available at each keypad.
n. The system shall offer multiple language support that can be assigned per keypad. Languages supported must include English, Latin American Spanish, Portuguese and/or Canadian French.
o. The IDS shall support flash firmware upgrades of systems firmware for the control panel and peripherals, allowing for future updates.
p. Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.
q. Provide 1.4 amps of power for standby operation and 2.0 amps of alarm power, both rated at 12 VDC.
r. 3 configurable form ‘C’ wet or dry-contact relay outputs with expansion capability for up to an additional 472 dry-contact relay outputs.
s. Integrated battery charger with reverse hook up protection, battery supervision and battery deep discharge protection.
t. Supervision of peripheral devices and communications interface(s).

B. Point Functionality and Expansion:

1. Each point in the system shall be programmable to provide the following type of response in the system:

a. Always on (24 hour response).
b. On when the system is Master Armed.
c. Only on when the system is Perimeter Armed.
d. Displays / Does Not Display at the ACC when the point is activated.
e. Provides / Does Not Provide entry warning tone.
f. Sounds / Does Not Sound audible alarm indication.
g. The Point is bypassable / not bypassable.
h. Alarm Verification with programmable verification time.
i. Relay activation by Point.
j. Provides / Does Not Provide "watch point" capability.
k. Provides Swinger Bypass.
l. Defers Bypass Report.

m. Can return to the system after being force armed and then restoring.
n. Can return to the system after being bypassed and then restoring.

2. The IDS shall be capable of supporting "group zoning." Group zoning refers to the combining of points into a separately identifiable and separately annunciated (programmable text) areas.
3. The IDS shall be capable of allowing variable point response times via programming. Point response times shall be programmable over a range of 300 milliseconds to 4.5 seconds.
4. The IDS shall have the capability to expand up to 246 separately identifiable points, of which 8 are on-board and 238 are off-board wired or wireless addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.

    a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.
    b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.

5. The IDS shall have the capability to expand up to 75 separately identifiable points, of which 8 are on-board and 67 are off-board addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.

    a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.
    b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.

6. Capability to expand up to 40 separately identifiable points, of which 8 are on-board and 32 are off-board addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.

    a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.
    b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.

7. Capability to expand up to 40 separately-identifiable points of which 8 are on-board points and 32 are off-board addressable points connected to point expansion modules and/or wireless receivers.
8. Capability to expand up to 24 separately-identifiable points of which 8 are on-board points and 16 are off-board addressable points connected to point expansion modules and/or wireless receivers.

C. Areas/Accounts:

1. The IDS shall support 32 independent areas. Each of the 32 areas shall have custom text associated with the armed state, disarmed state and point-off-normal state.
2. The IDS shall be capable of assigning 1 to 4 account identifiers to the areas depending on the distribution of areas per account.
3. The IDS shall be capable of assigning 1 to 2 account identifiers to the areas depending on the distribution of areas per account.
4. All of the areas must be capable of Master (All) and/or Perimeter (Part) arming (excluding predefined Interior protection).

5. The IDS shall be capable of logically grouping 1 or more points into an area, or conversely, dividing 2 or more points into two or more areas.
6. Any area shall be configurable to allow arming by specific users when a programmable number of devices are faulted or bypassed.
7. Areas shall be independently controlled by their corresponding ACC.
8. Area(s) shall accommodate assignment of independent account numbers to define annunciation, control, and reporting functions.
9. The IDS shall be capable of linking multiple areas to a shared area which may be automatically controlled (hallway or lobby).
10. The IDS shall accommodate conditional area arming dependent on the state of other areas (master or associate). Any area can be configured for perimeter and interior arming, not requiring a separate area for this function.

D. Output Relay Expansion: The IDS shall provide the capability for output relay expansion using relay expansion modules. Independent control of relay functions by area shall be possible through programming assignments.

1. The IDS shall be capable of activating 472 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module.
2. The IDS shall be capable of activating 64 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module.
3. The IDS shall be capable of controlling relays and automatically executing system functions based on a time / event scheduling program. The program can be hour, day of week or day of month based.
4. Relays and other outputs may be programmed to follow up to 14 different area conditions or up to 12 panel conditions. Relays may also be programmed to follow individual points or groups of points.
5. The IDS shall support 5 different types of alarm output selections: Steady, Pulsed, California Standard, Temporal Code 3 and Temporal Code 4.

E. Scheduling: The IDS shall support scheduling capabilities with the following characteristics:

1. Arm / Disarm specific area(s) based on open/close windows.
2. Bypass / Unbypass point(s).
3. Activate / Deactivate relay(s).
4. Send test reports.
5. Up to 4 programmable holiday schedules of 366 days each (includes leap year). Based on the holiday settings, different time windows for open/close and other system functions can be executed.
6. Automatic adjustment of system clock for daylight savings time.

F. Alarm Keypads:

1. The IDS shall accommodate connection with up to 32 ACCs, each capable of displaying custom English, Latin American Spanish, Portuguese or Canadian French text on a liquid crystal display.
2. The Alarm Keypads shall accommodate viewing and configuration of system parameters including:

a. Network Parameters:

(1) DHCP Enable/Disable for the selected network module.
(2) UPnP Enable/Disable for the selected network module.
(3) IP Address for the selected network module
(4) Subnet Mask for the selected network module.
(5) Default Gateway for the selected network module.
(6) Port Number for the selected network module - The module's port number shall range from 0 to 65,535.
(7) DNS Server Address for the selected module's DNS server IP address
(8) DNS Host Name for the selected module. The DNS host name shall contain up to 63 characters.
(9) AES Encryption Key Size – Enable/Disable encryption by selecting the AES encryption key size for the selected network module.
(10) AES Encryption Key String - The user shall be able to display, add and modify the AES encryption string based upon the key size previously configured for the selected network module.

b. Point Parameters:

(1) Point Selection between one and the maximum number of points in the control panel.
(2) Point Registration to allow system response from a specific physical point on any one of the expansion modules; On-board or Point expansion modules (wired or wireless)
(3) Wireless points shall be able to be enrolled in the system via an auto enrollment feature.

c. Event Routing Parameters to allow programming of up to 4 report routing groups as well as configuration of primary and secondary paths.

G. User Passcodes and Authority: Passcodes shall be programmable with authority levels to allow users to operate any or all areas.

1. Up to 2000 different passcodes shall be accommodated.
2. Each passcode shall be 3 to 6 digits (variable) and be assigned a 32-character user name.
3. User access to System features and functions shall be configurable based on 14 individually programmable levels of authority assigned to the user passcode. Additionally, the system shall have the capability to assign to the user passcode, a different authority level in each of the areas. A service passcode can be assigned to the servicing agent allowing the agent limited access to system functions. User-programmable / activated functions include:

a. Arming the system: All areas, specific area(s) only, perimeter instant, perimeter delayed, perimeter partial, watch mode, and arming the system with a duress passcode.
b. Disarming the system: All areas, specific area(s) only and disarming with a duress passcode.
c. Viewing system status: Faulted points, event memory, bypassed points, area status and point status.
d. Implementation functions: Bypass a point, unbypass a point, reset sensors, silence bell, activating relays, initiating the remote programming function locally to allow programming the system from a remote location.

e. Testing the system: Local Walk test, Service Walk test, Fire test, send report to remote IDS controllers to check the telephone link, and programming the time and date for the next test report transmission.
f. Change system parameters: ACC display brightness, system time and date, and add/delete/change passcodes.
g. Extend the closing time of the system.
h. Transmitting special alerts and activating audible and visible signals.
i. Executing multiple commands / ACC keystrokes from a single Menu / Command List item. This function shall be able to have a 32 character (alphanumeric) title to identify it on the ACC display.
j. Editing of time / event based scheduling program from the ACC.
k. The IDS shall also provide a "service menu" to implement functions such as viewing and printing the system log, displaying the system firmware revision number, and defaulting (toggling) text displays between custom and default text displays for troubleshooting.

4. The IDS shall allow users to change their own user passcode from the Alarm Keypad (ACC). Managers shall be capable of changing the user passcodes and authority assignments by area of other users from the ACC.
5. The IDS shall incorporate a programmable "Passcode Follows Scope" feature to allow users to arm or disarm only the area they are entering with one simple command or control all areas from one ACC.

H. Communication: The IDS shall be capable of reporting system events and supervisory reports including alarm, trouble, missing modules, restorals, system status, AC failure, battery status to primary and secondary off-site remote IDS controllers. The following features shall be supported.

1. The IDS shall be capable of communicating via dial-up analog telephone lines, over a LAN/WAN/Internet using a wired network interface module, or over a cellular network using a CDMA Cellular interface module.
2. The Bosch Modem4 communications format shall be utilized for optimum system performance. The Modem4 format provides the maximum data information to the receiver for alarms, troubles, restorals, bypasses, relay activation, opening/closings, and card access. The detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information. As an alternative format, Contact ID may be used although it will include less detailed information like point or user text.
3. The IDS shall be capable of sending text (SMS) messages to compatible devices without requiring that these message are sent to a monitoring center.
4. The IDS shall have the capability of communicating with up to 8 different remote IDS controllers using up to 4 different phone numbers, up to 24-digits in length and/or 4 URL/IP addresses over a network.
5. The IDS shall report to a Commercial Central Station that is using a Bosch D6600 Receiver/Gateway or a Bosch D6100i Receiver using Modem4 as a preferred format or Contact ID as an alternate format.
6. The remote IDS controllers shall provide the transmission information sent from the IDS that includes alarms, troubles, restorals, bypasses, relay activation, opening/closings, and card access. When using the ModemIIIa² format the detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information.
7. The IDS reports shall be classified, by event, into eleven subcategories or "report groups." Each group represents similar types of events. Individual events within each group shall be selectively enabled or disabled for transmission. The eleven report groups shall be as follows:

a. Fire Reports.
b. Burglar Reports.
c. User Reports.
d. Test Reports.
e. Diagnostic Reports.
f. Relay Reports.
g. Auto Function Reports.
h. RPS Reports.
i. Point Reports.
j. User Change Reports.
k. Access Reports.

8. The IDS shall have the capability to verify the integrity of the remote communications path and switch to alternate paths when a communications failure occurs.
9. The IDS shall be capable of unattended mode of operation whereby programming and configuration updates are automatically transferred using the Remote Programming Software (RPS). These updates can initiate from either the control panel or the remote computer using RPS.

I. Network Communication: The IDS shall be capable of network communications over a LAN, WAN, Intranet, or the Internet. The system shall include supervision of the network communication utilizing configurable periodic heartbeats to the Digital Alarm Communications Receiver (remote IDS controllers). The remote IDS controllers shall provide notification of the loss of communications from a networked system after a programmable timeframe since the last communication. The notification options shall be programmable and include local annunciation or indication to automation software.

1. The network interface module shall be capable of supporting Dynamic Host Communication Protocol (DHCP) to obtain an IP Address.
2. The system shall support a method of authentication between the control panel and the receiver to ensure that the control panel has not been compromised or replaced.
3. The network interface modules shall be capable of supporting encryption using a minimum of 256-bit AES Encryption (Rijndael) certified by NIST (National Institute of Standards and Technology) utilizing the Cipher Block Chaining (CBC) method.
4. The network interface module shall support a 10/100BaseT connection to an Ethernet network.
5. The control panel shall be capable of network communication with a programmable poll time to send periodic heartbeats to the receiver, programmable ACK Wait time, and programmable retry time. In the situation where a communication path is unsuccessful, the control panel shall be capable of attempting backup communication through an available communication method to the same receiver or a backup receiver.

a. The control panel shall have the ability to automatically adjust the heartbeat rate of a backup path that is using cellular to the heartbeat rate of the primary path in case of a primary path failure. Upon restoral of the primary path, the heartbeat rate of the backup path shall automatically restore to the original rate. This allows a system utilizing cellular communications to keep the wireless charges low.
b. The network communication between the control panel and the receiver shall use Modem4 or Contact ID.

c. The control panel shall be capable of two-way communication using a wired network interface module with a 10/100BaseT on a LAN/WAN/Internet configuration or with a cellular module on the Internet.
d. The control panel shall be capable of configuring the destination of the receiver using a URL or static IP Address.
e. The control panel shall be capable of using DNS to lookup the IP Address of the receiver when programmed with a URL.
f. The control panel shall support UPnP for automated Port Forward configuration in the router where the control panel is installed.
g. The control panel shall support AutoIP to enable the RPS software to connect to the control panel locally using an IP Direct connection.
h. The control panel shall support configuration of the IP parameters from the keypad eliminating the need for a PC to configure the IP device.
i. The control panel shall support network diagnostics from a keypad to allow local testing of network connectivity. The diagnostics should include, Ethernet cable connected, gateway configuration ok, DNS lookup operational, and external network connectivity (such as the Internet) operational.
j. The system shall be capable of meeting DCID 6/9 and UL 2050 standards.

J. Event Log: The IDS shall maintain a log of events indicating time, day, month, year type of event, account number, area number, user ID, point text, user text and primary/secondary event route. The system shall allow the following characteristics:

1. The IDS shall be capable of storing up to 10,000 events
2. The IDS shall support viewing of logs locally at the ACC and remotely via an upload to a remote central station computer running the RPS software.
3. The IDS shall provide notification via a report to the remote IDS controllers when the event log reaches a programmable “percent full capacity". This allows retrieval of stored events via RPS to prevent any loss of event history.
4. Group, signal type and area can route events to specific receivers.
5. Each remote IDS controllers shall be designated as a primary, backup, or duplicate destination for each report group. Assigning an event to multiple routing groups provides for duplicate destinations for the event. The transmission of grouped events allows the reporting of different types of information to different remote IDS controllers.

K. Testing, Diagnostic, and Programming Facilities: The IDS shall be capable of sending (manually or automatically) test and status reports to remote IDS controllers.

1. The IDS shall be capable of sending automatic tests daily, weekly or once every 28 days. Automatic test times shall be programmable to provide an offset of up to 24 hours from the current time.
2. Automatic test reports shall be programmable to be deferred by one test interval if any other report is transmitted in the current interval.
3. Automatic test reports and remote system access for diagnostics shall be supported via a remote central station computer with Remote Programming Software (RPS).
4. The IDS shall be programmable locally or remotely. Programming shall be accomplished via a Keypad or a computer with a remote programmer and diagnostic software package (RPS).
5. The IDS shall allow an on-site user to initiate remote programming while on-line with the servicing location. The remote programming device must provide a compare feature and allow for downloading either the stored program or the (un)modified program copied from the panel.

6. The IDS shall allow the local programming option to be disabled and must provide a method to program a panel while no one is on premises, when the panel shares a line with an answering machine.
7. The IDS shall accommodate IP Diagnostic to verify settings and operation of the network interface modules; Host name, MAC address, IPV4 address assignment. The IP Connection test shall include; Link test to verify physical cable integrity, Ping test to verify gateway response, ping test to verify address on the internet.
8. Wireless point diagnostics shall include signal strength and device states of registered wireless points in the system.
9. The number of system testing and programming sessions shall be restricted via the use of program locking features and passwords. Passcode protection in excess of sixteen million combinations is required.
10. New modules support enhanced diagnostics through RPS.

L. Miscellaneous Features: Programmable alarm output timer, 4 programmable entry delay times, exit delay programmable by area, individually programmable point of protection text, point bypassing, key switch arming capability with LED outputs, and fire verification.

M. Area Re-Arm: The System shall support programmable area re-arm time of 1 minute to 24 hour.

N. User-Programmable Features: The IDS shall provide a menu driven interface to provide a user-friendly command structure for programming / customizing the system to the operational criteria of the application. The IDS shall be capable of being operated via:

1. The Command Structure.
2. Menu / Command List.

2.3 SYSTEM INTERFACE REQUIREMENTS

A. Grounding: The Contractor shall properly earth ground the IDS to prevent electrostatic charges and other transient electrical surges from damaging the IDS panel.

B. Primary power: The Contractor shall provide a dedicated 120 VAC power circuit to the IDS system. This circuit shall be connected to the emergency power system. The 120 VAC is stepped down to power the IDS panel using a class two, plug-in transformer. This power circuit shall be properly rated to continuously power all points and functions indefinitely in full alarm condition.

C. Primary power supervision: When the primary power source fails, the system can be configured to report an "AC Fail" message to a commercial central station.

1. The message can also be programmed to "tag-along" with another message transmitted to the central station.
2. The system will always display a loss of primary power on the ACC and may be configured to provide additional audible warning.
3. The transmission delay of this message is programmable from 5 seconds to 86 minutes with an optional 6 to 12 hour transmission delay.

D. Secondary power (standby battery): The Contractor shall provide adequate battery power as defined by the relevant application criteria, (UL 864 and UL 985 for alarm installations or NFPA 72 chapters for fire applications). Appropriate battery chargers shall be provided consistent with the battery back-up capacity. The most current accepted version of NFPA 72 and any applicable local codes or AHJ requirements must be met accordingly.

E. Secondary power supervision: When the secondary power source experiences a 85 percent depletion of its standby capacity, the system can be configured to report a "Low Battery" message to a commercial central station. The system will always display a low battery condition on the ACC and may be configured to provide additional audible warning.

F. Cellular telephone interface: The control panel in the IDS shall be equipped with a cellular dialer for dial out monitoring of alarms.

G. Ethernet Interface: The IDS may use an Ethernet interface module as the primary, or back-up means of communicating to a remote IDS controllers.

1. The telephone line interface shall conform with FCC rules (Title 47 C.F.R. part 68).

H. Cellular interface: The IDS may use a cellular radio module as the primary, or backup, means of communicating to a remote IDS controllers. Up to 4 IP Addresses shall be available for routing system events. The supervision time shall be programmable with a range of 5 to 65,535 seconds. The module shall accommodate 128 and 256-bit AES encryption using CBC (Cipher Block Chaining) mode.

I. Auxiliary function control interfaces: The IDS shall accommodate auxiliary functions such as activating bells, strobes, or lights and shall be accomplished using the optional application specific relay modules. These auxiliary interfaces shall be electrically isolated to avoid inter-system interferences or damage to the system.

J. Wiring: The contractor shall provide cables consistent with the manufacturer's recommendations. The following general guidelines shall be followed for wiring installation:

1. Wiring shall be appropriately color-coded with permanent wire markers. Copper conductors shall be used.
2. All signal cables provided under this contract shall be Class II, plenum-rated cable where required. Where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway.
3. Data wires shall not be enclosed in conduit or raceways containing AC power wires.

K. Environmental Conditions: The IDS shall be designed to meet the following environmental conditions:

1. The system shall be designed for a storage temperature of -10° C to 70°C (14° F to 158°F).
2. The system shall be designed for an operating temperature of 0° C to 50°C (32° F to 120°F).
3. The system shall be designed for normal operation in an 85% relative humidity environment.
4. The system shall meet or exceed the requirements of FCC rules Title 47 C.F.R. Part 15, Class B devices, and Part 68, IEC EMC directive

2.4 ACCEPTABLE PRODUCTS

A. Intrusion Detection System Panel, Accessories and Field Devices. Provide quantity of field devices as shown on the drawings.

1. Intrusion Detection Control Panel & Components:

a. Control Panel: Bosch B9512G.
b. Verizon Compatible Cellular Dialer Card: Bosch B444-V2.
c. Universal Enclosure: Bosch B8103.
d. Lock and Key Set: Bosch D101.
e. Enclosure Tamper Switch: Bosch D110.
f. Transformer: Bosch D1640.
g. Power Supply: Bosch B520.
h. Battery Backup: Bosch D1218.
i. No Substitutions.

2. Addressable 8-Input Modules:

a. Bosch B208.
b. No Substitutions.

3. Addressable Polling Modules:

a. Bosch B299.
b. No Substitutions.

4. Addressable “POPIT” Modules:

a. Bosch D9127U.
b. No Substitutions.

5. Magnetic Door Position Contacts.

a. Monitored Doors: GE 1078.
b. Doors with Access Control: GE1076D.
c. No Substitutions.

6. PIR Motion Detectors:

a. Motion Detector: Bosch ISC-PPR1-WA16G.
b. Mounting Bracket: Bosch B328.
c. No Substitutions.

7. Touch Panel Keypads:

a. Bosch B942W.
b. No Substitutions.

8. Programming Software:

a. Bosch RPS-LITE.
b. No Substitutions.

9. 8-Output Relay Module.

a. Bosch B308.
b. No Substitutions.

B. Cabling:

1. Install riser rated (CMR) 18/4 cable from the security control panel to all devices.

a. Acceptable Manufacturers:

(1) Alpha Wire, Belden, CommScope, Tappan or WestPenn.
(2) Or approved equal.

2. Install OSP rated 18/4 cable suitable for underground duct installation from the main security control panel to all remote sub-panels.

a. Acceptable Manufacturers:

(1) Alpha Wire, Belden, CommScope, Tappan or WestPenn.
(2) Or approved equal.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

A. The site shall be visited on a regular basis to appraise ongoing progress of other trades and contracts, make allowances for all ongoing work, and coordinate the requirements of this contract in a timely manner.

B. INTRUSION DETECTION CABLE ROUTING AND TERMINATION

1. Route all cable in conduit. No exposed cabling is permitted. Conduit from the field devices to be terminated on a 4” high x 4” deep x 30” wide wiring gutter mounted above the security equipment enclosure in the telecom room.
2. Installation of networking cabling to the main control panel shall follow the installation and testing requirements of the Division 27 specifications.
3. All conduit shall be routed concealed. Where this is not possible, notify the Architect and provide proposed routing of exposed conduit for approval. Paint exposed conduit to match existing surfaces.
4. Install access panels as necessary to provide reasonable access to security cable and junction boxes located above inaccessible ceilings.
5. Ten feet of cable slack shall be stored in the security cable above the security panel enclosure.
6. Cables shall be installed in continuous lengths from origin to destination (no splices).
7. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer’s requirements and reference documents.
8. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.
9. Cables shall be labeled with self-adhesive labels. At the intrusion detection panels, each cable shall be clearly labeled on the cable jacket 1” from the termination location.
10. Terminate security cables with insulated crimp type lugs.
11. When installing conduit, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).
    a. 6” clear from power conductors.
    b. 12” clear from fluorescent lighting fixtures and ballasts.
    c. 36” clear from transformers and motors.

3.2 LABELING

A. Label all intrusion detection system components and devices. Labels shall be placed in a concealed location and shall identify the ID of the device.

B. Label all intrusion detection system enclosures, power supplies and relays.

C. Label all batteries with the date that the batteries were installed.

D. Label all cables at the intrusion detection panels. Affix labels a minimum of 1 inch from the point of termination. Labels shall be placed so that they are clearly visible. Labels shall identify the ID of the device.

E. Install engraved name plates on all equipment enclosures.

3.3 GROUNDING

A. Ground system components to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.4 SYSTEM CONFIGURATION AND PROGRAMMING

A. Install, configure, program and test the intrusion detection system.

B. Meet with the Owner and determine the required operation, functionality, zoning and scheduling of the system. Program the system in accordance with the Owner's requirements.

C. Program system configuration parameters (hardware and software, zone/circuit numbers, communication parameters).

D. Program operational parameters such as opening/closing reports and windows, system response text (custom English) displays of events, activation of relays that drive auxiliary devices, and identifying types of zones/loops.

E. Program passcodes according to the authorities and functions defined by the Owner.

3.5 TESTING AND COMMISSIONING

A. The Contractor shall demonstrate the functionality of the System upon completion of installation, documenting the result of all tests and providing these results to the Owner. The System shall be tested in accordance with the following:

1. The contractor shall perform 100% testing of the security intrusion detection devices. All deficiencies shall be corrected and the devices re-tested.
2. The Contractor shall conduct a complete inspection and test of all installed equipment. This includes testing and verifying connection to equipment of other Divisions.
3. The Contractor shall provide staff to test all devices and all operational features of the System for witness by the Owner's representative and the Authority having jurisdiction. The Contractor shall provide two-way radio communications to assist in the testing. All testing must be witnessed by the owner's representative, prior to acceptance.
4. The testing and certification shall take place as follows:
    a. System shall be tested in conjunction with the manufacturer's representative.
    b. All deficiencies noted in the above test shall be corrected.

c. Test results shall be submitted to the consultant or owner's representative.
d. System test witnessed by owner's representative and correction of any deficiencies noted.
e. The owner's representative shall accept the System.
f. System test shall be witnessed by the Authority having Jurisdiction, and any deficiencies that are noted shall be corrected.

5. A letter of certification shall be provided to indicate that the tests have been performed and all devices are operational.

3.6 SYSTEM TRAINING

A. Provide qty two (2) hours of training to the Owner's staff on the operation of the system at the completion of the project.

END OF SECTION 283000

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes fire alarm control panels, manual fire alarm stations, automatic smoke and heat detectors, fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 72 - National Fire Alarm Code.

1.3 SYSTEM DESCRIPTION

Division 28 31 00 is a performance specification. The Contractor shall include all labor and materials to design and complete the entire fire alarm work as herein specified and/or indicated.

The fire alarm system shall be a voice alarm communications system.

The Contractor is to serve as the complete system designer and installer. A complete fire alarm system shall be designed, furnished, and installed by the Contractor including locations, types, and quantities of all devices, monitoring devices, and equipment required. Contractor's design shall be based on all bid documents, including but not limited to Electrical, Telecom, Mechanical, Fire Sprinkler, Kitchen, Architectural, and Structural documents. Contractor shall provide all devices, modules, etc. for a complete operating system as required by all applicable Codes and AHJ requirements. Therefore, it is the Contractor's responsibility to include in the bid price the complete design and installation of all devices (whether shown or not), wiring, head-end equipment, etc. to meet the applicable code and AHJ requirements. The Fire Alarm System is indicated on the drawings and specifications in either criteria or schematic form only.

The Contractor shall refer to Telecom drawings for information regarding Code Red system integration and monitoring of all emergency communication/code red systems. Submit shop drawing indicating code red strobe device locations to Engineer of Record and Owner for review prior to installation.

The installed Fire Alarm Control panel shall be provided with provisions for future connection to future school and be considered a 'node' at that time. Provide integral components and capability to facilitate connection to additional panels within future school build-out. Panel shall be fully capable of performance as specified in 'stand-alone' mode until future addition is constructed.

A. Fire Alarm System: NFPA 72, addressable and automatic local fire alarm system with connections to central station.

B. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
   1. Local fire alarm signaling devices sound and display with signal.
   2. Non-coded signal transmits to central station.

3. Location of alarm zone indicates on fire alarm control panel and on remote annunciator panel.
4. Signal transmits to building elevator control panel, initiating return to main floor or alternate floor and lockout for fire service.
5. Signal transmits to building mechanical controls, shutting down fans and operating dampers.
6. Signal transmits to release door hold-open devices.
7. Signal releases magnetic door hold opens.
8. Signal releases electric door locks.

C. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.

D. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:
1. Visual and audible trouble alarm indicates at fire alarm control panel.
2. Visual and audible trouble alarm indicates at remote annunciator panel.
3. Trouble signal transmits to central station.

1.4 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate annunciator layout, and design calculations. Provide separate shop drawing for review of Code Red amber strobe locations.

C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.

D. Test Reports: Indicate procedures and results for specified field testing and inspection.

E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

F. Contractor shall submit to the AHJ. Include all associated costs, fees, drawings, cut sheets, calculations for a complete submittal in bid price.

G. Contractor shall submit copies of installing company licensure, and individuals responsible on project site responsible for installation of all fire alarm devices and cabling. All individuals on site shall be at a minimum, NICET II certified and State of Nevada ‘F-card’ holders.

1.5 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents: After construction “as-built” drawings shall be provided to the WCSD Plant Facilities and Capital Projects & Planning Departments. “As-built” drawings shall be as specified in Part 1 of these Guidelines. No marked “jobsite copies” will be allowed. As-built drawings shall show all horn/strobes, heat and duct detectors, splitter points, pull stations, and their specific addresses. As-built shall also show floor to floor penetrations. In addition, door magnets (and their power source), burglar alarm devices, HVAC connections, dampers and contractors shall be shown. All other devices both electrical and mechanical not previously designated that are tied to Fire Alarm Panels or are a part of the Fire System Operation shall be shown.

C. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.

B. Installer: Certified fire alarm installer with service facilities within 100 miles of Project.

C. Design fire alarm under direct supervision of Professional Engineer or NICET II certification experienced in design of this Work and licensed in State of NV.

1.8 MAINTENANCE SERVICE

A. General Conditions: Maintenance service.

B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

1.9 MAINTENANCE MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish five manual station break-glass rods.

C. Furnish two keys of each type.

1.10 EXTRA MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish one of each type of automatic smoke detector without base.

PART 2 - PRODUCTS

2.1 CONTROL PANEL

A. Manufacturers – per WCSD Standards:
1. GE EST-4, no exceptions.

B. Product Description: Modular addressable fire alarm control panel with flush surface wall-mounted enclosure.

C. Power supply: Adequate to serve control panel modules, remote detectors, remote annunciators, smoke dampers, relays, and alarm signaling devices. Include battery-operated emergency

power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 15 minutes.

D. System Supervision: Component or power supply failure places system in trouble mode.

E. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition place's circuit in trouble mode.

F. Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode.

G. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver. Provide and install cellular dialer communicator listed for fire alarm panel monitoring. Locate equipment and antenna as required for optimal cell signal reception on premises. Provide conduit and wiring to exterior of structure to facilitate such signal.
   1. Coordinate with Owner for monitoring station account information prior to start of system installation. Contractor responsible for all requirements for complete system and monitoring.

H. Auxiliary Relays: Sufficient SPDT auxiliary relay contacts to provide accessory functions specified.

2.2 MANUAL FIRE ALARM STATIONS

A. Product Description: Manual double-action station with break-glass rod. Manual Pull Stations shall be constructed of metal and double-action (not break-glass type). Provide with STI Stopper® II with Horn or equivalent (clear, tamperproof polycarbonate cover with sounder) unless noted otherwise on plans.

B. Mounting: Semi-Flush.

C. Type: Coded.

D. Backbox: Manufacturer's standard.

2.3 SPOT HEAT DETECTOR

A. Product Description: Addressable combination rate-of-rise and fixed temperature, spot heat detector.

B. Temperature Rating: 135 degrees F (57 degrees C).

C. Rate-of-Rise: 15 degrees F (8.3 degrees C).

2.4 CEILING SMOKE DETECTOR

A. Product Description: NFPA 72, addressable photoelectric type ceiling smoke detector with the following features:
   1. Adjustable sensitivity.
   2. Plug-in base.
   3. Auxiliary relay contact.
   4. Integral thermal element rated 135 degrees F (57 degrees C).
   5. Visual indication of detector actuation.

B. Mounting: 4 inch (102 mm) outlet box.

C. Furnish two-wire detector with common power supply and signal circuits.

2.5 DUCT-MOUNTED SMOKE DETECTOR

A. Product Description: NFPA 72, addressable with the following features:
1. Auxiliary SPDT relay contact.
2. Key-operated normal-reset-test switch.
3. Duct sampling tubes extending width of duct.
4. Visual indication of detector actuation.
5. Duct-mounted housing.

B. Furnish two-wire detector with common power supply and signal circuits.

C. See mechanical plans for additional information.

2.6 ALARM STROBE

A. Provide low profile wall mounted. Low profile strobes shall mount in a North American 1-gang box, and protrude less than 1” from the finished wall. The word FIRE shall be prominently displayed on the housing. All devices shall be WHITE with RED lettering (confirm with architect).

B. The strobes shall be EDWARDS Genesis G1 Series.

2.7 REMOTE ANNUNCIATOR

A. Product Description: Remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Provide microphone for system input where shown, all other annunciators shall be LCD display only.

B. Mounting: Semi-flush mounting in factory provided backbox with lockable door and viewing window.

2.8 DOOR RELEASE

A. Product Description: See architectural hardware specifications. Provide all required connections/wiring, relays, modules, and transformers as required.

2.9 WIRE AND CABLE

A. All wiring shall be routed in ¾” Conduit (Minimum), factory painted red. Exposed red conduit in finish areas is not acceptable. Obrain approval from Project Manager and/or Project Architect prior to routing any exposed conduit.

B. All fire alarm conductors routed underground shall be wet location rated.

C. Fire alarm circuit conductors have insulation color or code as follows:
1. Power Branch Circuit Conductors: Black, red, white.
2. Initiating Device Circuit: Black, red.
3. Detector Power Supply: Violet, brown.
4. Signal Device Circuit: Blue (positive), white (negative).
5. Door Release: Gray, gray.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify products and systems receiving devices are ready for installation.

3.2 INSTALLATION

A. Install manual station with operating handle 48 inches above floor.

B. Install audible and visual signal devices 80 inches above floor to bottom of device.

C. Install 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors in conduit.

D. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

E. Mount outlet box for electric door holder to withstand pulling force of specified door holder.

F. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, and duct smoke detectors.

G. Automatic Detector Installation: Conform to NFPA 72.

H. Install engraved plastic nameplates in accordance with Specifications.

I. Ground and bond fire alarm equipment and circuits in accordance with Section 26 05 26.

J. Fire Alarm Junction Boxes shall be painted RED with labeling indicating circuiting inside junction box, such as “FIRE ALARM – STROBE - BPS 2 CIRCUIT 1”.

K. Addressable devices shall be provided with labels indicating device address. Relays, control modules, monitor modules or other devices of similar type shall be labeled with their function and address, such as “HP-19 SHUTDOWN RELAY”.

L. All devices subject to physical damage where installed shall be provided with a manufacturer’s protective device cage.

3.3 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Test in accordance with NFPA 72 and local fire department requirements.

3.4 MANUFACTURER'S FIELD SERVICES

A. General Conditions: Manufacturer’s field services.

B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.5 DEMONSTRATION AND TRAINING

A. Furnish 4 hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

END OF SECTION 28 31 00

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Standard Specifications for Public Works Construction, 2016 Edition, as adopted by the City of Reno.

C. Geotechnical Investigation Report, titled Libby Booth Elementary School Modernization STEAM Building Project by Construction Materials Engineers, Inc. dated February 2026.

D. SUMMARY

E. The project requirements for Rough Grading and Site Earthwork shall be those specified in Sections.

1. 302 – Subgrade Preparation
2. 303 – Unclassified Excavation
3. 304 – Unclassified Fill
4. 305 – Trench Excavation and Backfill

of the Standard Specifications for Public Works Construction, Latest Edition, contract documents and the Geotechnical Investigation Report, Geotechnical Evaluation Echo Loder Elementary School, dated November 25, 2024, prepared by Geotechnical & Environmental Services, Incorporated.

, the requirements stated herein and the requirements shown on the contract documents.

1.2 SUBMITTALS

A. Test Reports: Testing laboratory will submit the following reports directly to the architect and shall copy the contractor:

1. Analysis of soil materials, whether procured on or off site, and including fill, backfill, and barrow materials.
2. Verification of each footing subgrade.
3. Comprehensive strength or bearing test reports.

1.3 QUALITY ASSURANCE

A. Testing Laboratory Services: The owner will secure and pay for the services of a geotechnical engineer to classify existing soil materials, to recommend and to classify proposed borrow materials when necessary, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing.

1.4 SITE CONDITIONS

A. Traffic: Do not interfere with or close public ways without permission of governing authorities. Do not interfere with adjacent private facilities.

B. Site Utilities:

1. Advise utility companies of excavation activities before starting excavations. Locate and identify underground utilities passing through work area before starting work
2. Protect existing utilities indicated to remain.
3. Do not interrupt existing utilities without advance notice to and written approval from the owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where sufficient approved materials are not available from required excavations on site, obtain and pay for materials from approved sources off site without charge to the owner.

B. Before each soil material proposed for use as fill or backfill, whether obtained on or off site, testing laboratory shall classify soil material, develop Proctor curve, and perform any other tests required.

C. Obtain approval of the architect for each soil material.

D. Backfill and Fill Materials: Materials classified as satisfactory.

E. Satisfactory Soils: Those complying with Geotechnical Inspection Requirements.

F. Unsatisfactory Soils: Those not complying with Geotechnical Inspection Requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection: Provide markers indicating limits of work and clear identification of items and areas requiring protection.

B. Provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

C. The contractor is solely responsible for determining the potential for injury to persons and damage to property.

1. Where such potential is present, take appropriate protective measures. Protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

3.2 EROSION CONTROL

A. To the maximum extent practicable, prevent erosion or displacement of soils and discharge of soil-bearing water runoff to adjacent properties and waterways.

B. Provide erosion control during the entire project in accordance with applicable regulations.

C. The contractor shall file a Notice of Intent with the Nevada Department of Environmental Protection and provide the required Storm Water Pollution Prevention Plan.

3.3 PROTECTION OF TREES

A. Provide temporary guards to protect trees and vegetation to remain. Place guards so as to prevent all forms of vehicular traffic or parking within drip lines.

1. Do not allow excess foot traffic within drip lines.
2. Do not stockpile construction materials, soil, or aggregates within drip lines.
3. Water trees and other vegetation to remain within limits of the area of construction activities as required maintaining their health during course of construction operations.

3.4 DEWATERING

A. Do not allow surface or ground water to flow into or accumulate in excavations.

B. Do not allow water to flow in an uncontrolled fashion across the project site or to erode slopes or to undermine foundations. Do not allow water to be diverted onto adjacent properties. Arrange excavation operations so as to provide continual and effective drainage of excavations.

C. Provide and maintain temporary diversion ditches, dikes, and grading as necessary; do not use trench excavations for this purpose. When required by surface or subsurface water conditions, provide sumps, well points, french drains, pumps, and other control measures necessary to keep excavations free of water. When existence of ground water near or above final excavation level is indicated or suspected, provide control measures prior to excavating to water level and maintain water level continuously below working level.

3.5 EXCAVATION

A. Explosives: Do not use explosives.

B. General: Excavation includes the removal of any materials necessary to achieve the required subgrade elevations and includes re-use or disposal of such materials.

1. Excavation will not be classified for payment purposes to distinguish between earth, rock, obstructions, or other materials.

C. Unnecessary Excavation: The expense of excavation of materials outside of limits indicated or ordered in writing by the architect and the correction thereof to the satisfaction of the architects shall be borne by the contractor.

1. Unnecessary excavation under footings: Either deepen footings to bear on actual subgrade elevation without changing top elevations or place concrete fill up to required elevation, as required by the architect.
2. Unnecessary excavation other than under footings: Either place compacted fill or otherwise correct conditions, as required by the architect.

D. Approval of Subgrade: Notify the architect when required elevations have been reached.

1. When required by the architect due to the unforeseen presence of unsatisfactory materials or other factors, perform additional excavation and replace with approved compacted fill material in accordance with the architect’s instructions.

2. Payment for unforeseen additional work will be made in accordance with provisions for changes in the work. No payment will be made for correction of subgrades improperly protected against damage from freeze-thaw or accumulation of water, or for correction of otherwise defective subgrades.

E. Excavation for Pavements: Excavate, shape, and compact to the lines, subgrade elevations, and cross sections indicated.

3.6 STORAGE

A. Stockpile materials to be used for filling and backfilling, including excavated materials classified as satisfactory soil materials, at locations indicated or as directed. Stockpile in a manner to freely drain surface water: cover if necessary to prevent wind-blown dust.

1. Store soil materials without intermixing. Protect from contamination with other soils or debris.
2. Do not stockpile materials inside of drip line of trees to remain.

3.7 BACKFILLING

A. Installation: Place approved soil materials in layers to required elevations.

1. Do not place material on muddy or frozen surfaces or on surfaces containing frost.

B. Installation: Place satisfactory soils materials in layers to required subgrade elevations.

3.8 FILLING

A. Preparation: Verify that area has been stripped of vegetation including roots below grade. Remove and dispose of any unsatisfactory soils.

1. When filling slopes steeper than 1 in 4 rise, plow, step, or break up surfaces to promote bond of new to existing material.
2. Should density of subgrade to receive fill be less than specified for fill, break up and pulverize subgrade to a depth of at least 6 inches, moisture condition if necessary, and recompact to required density at optimum moisture content.

3.9 Pavement and Building Subbase Course Placement

A. Place lifts such that compaction true to grade and level is accomplished with a minimum of surface disturbance and segregation of degradation of materials. Maintain grade control and cross section by means of line and grade stakes. Maintain moisture content within prescribed limits during placing and compacting.

B. When the total thickness of subbase is less than the maximum lift thickness permitted, place material in a single lift. When the total thickness of subbase is greater than the maximum lift thickness permitted, place materials in two or more lifts of uniform thickness with no lift less than 3 inches in thickness.

C. Place materials along the edges of the subbase course so as to maintain compaction of the subbase course. Construct at least a foot width of shoulder simultaneously with each lift of the subbase course.

D. Cut any overbuild to grade. Should top elevation be lower that allowable tolerances, scarify to a depth of 3 inches, add new material, and recompact to bring to grade within required tolerances.

3.10 COMPACTION

A. Place materials used in backfilling and filling in layers not exceeding loose depths as follows:

1. Heavy equipment compaction: 8 inches.
2. Hand-operated tampers: 4 inches.

B. Place material simultaneously on opposite sides of walls, small structures, utility lines, etc. to avoid displacement or overstressing.

C. In-Place Density Requirements: Compact soil to not less than the values given within the soils report prepared by Black Eagle Consulting, expressed as a percentage of maximum density at optimum moisture content.

D. Moisture Control: During compaction, control moisture of subgrades and subsequent lifts to within tolerances from optimum moisture content as recommended by testing laboratory. Wet surface with water when additional moisture is required. Aerate soil to aid in drying or replace soil when excessive moisture is present.

3.11 GRADING

A. General: smooth grade to a uniform surface that complies with compaction requirements and required lines, grades, and cross sections and is free from irregular surface changes.

B. Provide smooth transition between existing adjacent grades and changed grades. Cut out soft spots, fill low spots, and cut down high spots to conform to required surface tolerances.

C. Slope grades to direct water away from structures and to prevent ponding. Finish subgrade to required elevations within the following tolerance:

1. Paved areas: Plus or minus 0.05 foot.
2. Exterior steps and ramps: Plus or minus 0.05 foot.

3.12 PROOFROLLING

A. After completion of required compaction and immediately prior to proceeding with subsequent construction, proofroll in the presence of testing laboratory representative.

B. Proofroll using a heavy pneumatic-tired vehicle having four tires abreast, each tire loaded to 30,000 pounds and tire inflated to 150 psi. Provide 30 coverage’s of the area to be proofrolled, one coverage being defined as the application of one tire print over the entire area. Maintain optimum moisture content during proofrolling. In areas which show pumping or which are otherwise unsatisfactory, undercut fill material and replace with compacted fill, or stabilize in place, as required by the architect.

C. Proofroll areas to receive:

1. Pavement.
2. Building slabs on grade.

3.13 FIELD QUALITY CONTROL

A. Testing Laboratory Services: Provide timely notice to testing laboratory, Do not proceed with construction until testing of each subgrade and lift of fill or backfill has been performed and required inspections and approvals have been obtained.

B. Maximum Density at Optimum Moisture Content: Determine in accordance with ASTM D-1557 (Modified Proctor).

C. In-Place Density Tests: ASTM D-1556 (sand cone method), ASTM D-2167 (rubber balloon method), or ASTM D-2922 (nuclear method), as applicable.

D. If testing service reports indicate that subgrade or fills are below specified density, scarify or remove and replace to the required depth, recompact, and retest at no cost to the owner.

3.14 MAINTENANCE

A. Completed Areas: Protect from damage by pedestrian or vehicular traffic, freezing, erosion, and contamination with foreign materials.

1. Repair and re-establish grades to specified tolerances in settled, eroded, or rutted areas.

B. Damaged Areas: Where completed or partially competed surfaces become eroded, rutted, settled, or lose compaction and whether due to subsequent construction operations or weather conditions, restore materials to required conditions: Scarify or remove and replace to the required depth, return to optimum moisture content, and compact materials to the required density before continuing construction.

C. Correction: Should settling occur within the project correction period, remove finished surfacing, add additional approved material, compact material, and reconstruct surfacing. Construct surfacing to match and blend in with adjacent surfacing as nearly as practicable.

3.15 DISPOSAL OF EXCESS WASTE AND MATERIALS

A. Remove any material not required for use on the project (including organic strippings, trash, and debris) and legally dispose of it off the owner’s property.

END OF SECTION 312000

SECTION 31 22 01 - STRUCTURAL EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section is intended to apply to portions of the Work which are directly below or adjacent to the building structure. Provide all site stripping, excavation, fill, backfill, and grading, as specified therein, and as noted on or required by the Structural Drawings.

B. The geotechnical requirements noted herein are minimums. Where differences between these requirements and those specified in the Geotechnical Investigation occur, the more stringent requirement shall govern.

1.2 QUALITY ASSURANCE

A. Geotechnical Engineer: The Owner will retain and pay the expenses of a Geotechnical Engineer for performing testing, Special Inspection, material approval, soils verification, observation, and other functions as specified in the Contract Documents. The Geotechnical Engineer shall communicate only with the Owner and the Architect, and with the Contractor as directed by the Architect. The Architect shall relay any appropriate instructions to the Contractor within the provisions of the Contract Documents.

B. Testing Agency: Local testing laboratory with a minimum of three years experience in testing soil materials. All reports prepared by the Testing Agency shall be signed by a Professional Engineer registered to practice as a Civil Engineer in the state of Nevada.

C. Testing Laboratory shall have the same required qualifications as the Testing Agency but shall be retained by the Owner. Testing laboratory will make field tests as directed of the "in place" materials to assure conformance with Contract Documents.

D. Source Quality Control: Prior to delivery to site, the Testing Agency shall test all imported soil material for conformance with Contract Documents. Also, on-site fill materials shall be approved by the Geotechnical Engineer prior to placing.

E. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

F. Use equipment adequate in size, capacity, and numbers to accomplish the Work of this Section in a timely manner.

G. In addition to complying with the requirements of governmental agencies having jurisdiction, comply with the directions of the Geotechnical Engineer, as approved by the Architect.

H. Reference Standards:

1. ASTM - American Society for Testing and Materials.
    a. D 6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
    b. D 4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

c. D 1556 - Standard Test Method for Density of Soil in Place by the Sand Cone Method.
d. D 1557 - Standard Test Methods for Moisture-Density Relations of Soils Using 10-pound Rammer and 18-inch Drop.
e. D 2487 - Classification of Soils for Engineering Purposes.
f. D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods

2. State of Nevada, Standard Specifications for Road and Bridge Construction.
3. American Water Works Association (AAWA) Standard Methods for Examination of Water and Wastewater
   a. 2540 C
   b. 4500-SO_4^{2-} E
   c. 4500-Cl B

1.3 SUBMITTALS

A. Test Reports: Submit test reports on proposed import and native materials, and compaction test reports on all compacted materials.

B. Submit manufacturer's product data and installation instructions for proprietary materials including vapor barrier, filter fabric, drain fabric, and the like.

1.4 JOB CONDITIONS

A. Existing Conditions:

1. Soils Data: Geotechnical Investigation (File 4104), dated March 2026, by Construction Materials Engineers, Inc.
   a. The records of investigation of soil or subsurface conditions and logs of test borings are made available by the Architect. It is expressly understood and agreed that the Architect assumes no responsibility whatsoever in respect to the sufficiency or accuracy of the interpretations set forth therein and there is no warranty, either expressed or implied, that the conditions indicated by such investigations or records are representative of those existing throughout such areas or any part thereof, or that material other than, or in proportions different from those indicated, may not be encountered.
   b. The availability or use of the records of investigations of soil or subsurface conditions and/or logs of test borings
      1) shall not be construed as a waiver of the Contractor’s duty to examine the site of the Work as contemplated and the Contractor is cautioned to make such independent investigations and examinations as he deems necessary to satisfy himself as to the subsurface conditions to be encountered in the performance of the Work and
      2) will not relieve the Contractor from the risk of unanticipated soil or subsurface conditions or from properly fulfilling the terms of the Contract for the Contract Sum.
2. Information shown on the Drawings regarding existing site conditions is believed to be correct, but it is not guaranteed. Contractors shall visit the site for necessary information and data regarding present ground levels, ground water level, conditions of property, locations and size of obstructions, and access, etc.
3. There may be underground utilities, storm drains, and other previous improvements throughout the building site requiring removal. Known utilities and improvements are shown on the Civil drawings. Where existing utilities are encountered which are not

shown on the Drawings or evident from a site inspection, contact the Architect immediately for instructions. If such lines are inadvertently broken through no fault of the Contractor's operation, they shall be repaired by the Contractor, and an adjustment will be made in payment by the Owner. Breakage of lines shown on the Drawings or evident by a site inspection will be repaired by the Contractor at no increase in the Contract Sum.

B. Protection:

1. Provide, and maintain all barricades, shoring, bracing, etc., as required by federal and State codes. Contractor shall assume all responsibility for damage to utilities, streets, etc., that may be caused by this Work.
2. Maintain temporary drainage routes during construction so that rainfall or snow-melt will drain from site and not accumulate or pond.

C. Sequencing, Scheduling and Coordination: The Contractor may schedule and sequence his operations as he desires to optimize the Work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural fill shall be non-expansive, non-deleterious to concrete, free of organics, free of debris, and free of other deleterious materials. It shall meet ACI 318 table 19.3.1.1 sulfate class "S0". Neither recycled concrete nor asphalt are allowed for use as structural fill.

B. Onsite structural fill (approved soil generated from onsite grading) shall be screened to remove oversize particles. Grading shall have 100% passing the 4" sieve, 70% to 100% passing the 3/4" sieve, and less than 35% passing the #200 sieve. Plastic index shall be less than 15 or expansion index shall be less than 20.

C. Import structural fill (approved material from a commercial borrow source) gradation shall have 100% passing the 4" sieve, 70% to 100% passing the 3/4" sieve, and 15% to 65% passing the #40 sieve. Resistance (R) value shall be 30 minimum. Atterberg limits shall conform to the following:

Percent Passing No. 200 Sieve	Maximum Liquid Limit	Maximum Plasticity Index
5-15	≤45	≤14
16-35	≤40	≤10

All material shall be approved by the Geotechnical Engineer prior to delivery and/or use.

D. Non-structural fill shall be approved by the Geotechnical Engineer prior to delivery and/or use.

E. Drain Rock: Drain rock shall meet the requirements of Section 200.03 (SSPWC) for either a class C or D backfill as specified on the plans.

F. Aggregate Base for interior concrete slabs, exterior concrete slabs, and sidewalk base: Comply with SSPWC Section 200.01 Type 2, Class B, Aggregate Base.

G. Moisture Barrier: A moisture barrier shall be provided under all interior slabs on grade. It shall be placed directly below the aggregate base with edges lapped and sealed in accordance with manufacturer's recommendations. The moisture barrier shall be Mirafi "MCF-1212", Stego Wrap 15 mil, or equal.

H. Filter Fabric: Filter fabric shall have a minimum trapezoid tear strength of 80 lbs. per ASTM D4533, a minimum puncture strength of 500 lbs. per ASTM D4833, a minimum grab strength of 200 lbs. per ASTM D4632, a minimum burst strength of 250 psi per ASTM D3786, a minimum permittivity of 0.2/sec per ASTM D4491, and an AOS no greater than 0.25 mm per ASTM D4751. Filter fabric shall be Mirafi 180N, Propex Geotex 861 approved equal.

I. Drain Fabric: Where called for in the plans, drain fabric shall be installed behind retaining walls. Drain fabric shall be Mirafi G100W, Master Builders MasterSeal 974 or equal.

J. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Lay out the building and all site work in conformance with Contract Documents. Establish necessary benchmarks. Protect them and existing benchmarks shown on the Site Plan, until completion of the Work.

3.3 PERFORMANCE

A. Perform no earthwork during inclement weather, or when excessive moisture is present in the fill material.

B. Should rainfall or snow-melt occur following footing excavation and prior to pouring footing, dry the excavation thoroughly and re-compact the soils below the footing prior to placing footing.

C. Use no frozen fill. Place no fill on frozen ground.

D. Remove and replace in-place fills which are frozen prior to the placement of any additional fill.

E. When rains or snow-melt interrupt fill operations, inspect the surface before more fill is placed to assure that detrimental conditions do not exist.

F. Clearing and Grubbing: The areas to receive compacted fill for support of foundations, paving, and slabs shall be stripped of all debris, fill soils, crop growth, vegetation, surface trash, roots, and incidental topsoils, to a minimum depth of 12” below finished grade, as determined by the Geotechnical Engineer.

G. Stripping: The upper 6"± minimum, as determined by the Geotechnical Engineer, shall be removed from structural areas prior to placement of footings, aggregate base, or structural fill. Also any existing debris and former construction shall be completely removed from the site.

H. Excavation and Over-Excavation:

1. Excavate where necessary to obtain required subgrade elevations. In addition, over-excavate as necessary to remove the full depth undocumented fill, topsoil, surficial loose and/or disturbed soils fill from the building footprint as directed by the Geotechnical Engineer.
2. Excavate as necessary to allow room for placement and removal of foundation formwork.
3. Form all footings with wood, metal, or earth forms as specified in Section “Cast-in-place Concrete”.

I. Subgrade Stabilization: Dewater and stabilize subgrade where required and as directed by the Geotechnical Engineer.

J. Compaction of Exposed Soils:

1. Coarse grained soils containing nested cobbles or boulders larger than 6” in nominal diameter: Do not scarify. Clean exposed subgrade of loose or sloughing material and proof roll to confirm firm, stable, and unyielding subgrade prior to fill placement.

2. Clay Soils: Existing clay soils at the bottom of over-excavation shall be scarified to a depth of about 12 inches, moisture conditioned to within +2 to +4 percent above optimum moisture and compacted to 95% relative compaction. This moisture condition shall be maintained by periodic surface wetting or other approved methods until the surface is covered by at least one lift of fill.

3. Granular Soils: Granular soils with particle sizes generally 3 inches or less shall be scarified to a depth of about 8 inches, moisture conditioned to within ±2 percent of optimum moisture, and compacted to 95% relative compation.

K. Fill and Backfill:

1. Fill as required to obtain required subgrades.
2. Backfill foundations and stemwalls.
3. Place fill and backfill materials in 8-inch thick maximum loose layers. In general, place in horizontal layers extending uniformly over the area to be filled. Compact each layer as specified prior to placing the subsequent layer.
4. Water or dry fill materials as necessary to obtain moisture content +2% above optimum and as directed by the Geotechnical Engineer. These soils shall then be compacted to the following minimum densities, based on ASTM D1557 Method A or C.
    a. Structural fill – 95-percent relative compaction for fills under footings and slabs on grade.
    b. Non-structural fill on site – 90-percent relative compaction.

L. Aggregate Base and Drainrock:

1. Provide the aggregate base and compact to at least 95 percent relative compaction under pavement and other exterior and interior slabs. The upper 12” of subgrade below this base shall also be scarified, moisture conditioned and compacted to 90 percent relative compaction.
2. Establish finish grade of base at the required elevation with a level uniform surface varying not more than 1/2-inch when measured in any direction with a 10-foot straight edge.
3. Compact drainrock by five passes at right angles with an approved vibratory compactor.
4. Drainrock shall not be used as a substitute for aggregate base or structural fill.

M. Site Grading:

1. After completion of all excavation, fill and backfill, rake surface to a 4-inch depth to remove all rocks and debris in excess of 2-inches in diameter. Remove this material from the site.
2. Grade all areas including excavated and filled sections and transition areas to obtain a finished surface, reasonably smooth, compacted, and free from irregular surface changes. Leave all ditches, swales, and gutters finished to drain readily.

N. Moisture Barrier:

1. Where moisture barrier is required by plans, place moisture barrier beneath aggregate base. If required by ground conditions, a thin layer of clean sand shall be placed over the underlying subgrade soils to protect the barrier from damage.

2. Care shall be taken to avoid puncturing the membrane. No vehicle traffic is allowed directly on the membrane.

O. Drain Fabric:

1. Drain fabric shall be installed per manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

A. Soil Compaction Test: The Owner will pay the testing Laboratory for the first compaction test at any test location. All retests required because fill materials were not compacted to the required density shall be paid for by the Contractor.

B. The Geotechnical Engineer shall review all sitework and footing excavations before any concrete is cast, and submit a letter of compliance to the Architect. The Geotechnical Engineer shall review all backfill materials prior to placement and observe backfill operations. A letter of compliance shall be submitted to the Architect stating that fills have been constructed per the requirements of these Specifications.

C. Provide at least the following tests to the approval of the Geotechnical Engineer:

1. At paved areas, at least one (1) field density test for every 4000 sq. ft. of paved area, but not less than three (3) tests.
2. In each compacted fill layer, one (1) field density test for every 4000 sq. ft. of overlaying area, but not less than three (3) tests.

D. If, in the Geotechnical Engineer's opinion, based on reports of the testing laboratory, subgrade or fills have been placed below specified density, provide additional compacting and testing.

3.5 MAINTENANCE

A. Protection of newly graded areas:

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.
2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

C. Moisture levels at completed moisture-conditioned and compacted areas shall be maintained by periodic surface wetting, or other methods, until covered by at least 1 lift of fill. Where such areas are allowed to dry out, scarify to a depth of 8”, moisture condition, and compact to the required density prior to further construction.

END OF SECTION 31 22 01

SECTION 321123 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Standard Specifications for Public Works Construction, 2016 Edition, as adopted by the City of Reno.

C. Geotechnical Investigation Report, titled Libby Booth Elementary School Modernization STEAM Building Project by Construction Materials Engineers dated February 2026.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain required products from a single manufacturer.

1. Accessories: Provide accessory items only as produced or recommended by manufacturer of primary products.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregates for Surfacing and Base:

1. Aggregate shall be Type 2, Class B Aggregate Base as specified in the Standard Specifications.

2.2 SOURCE QUALITY CONTROL

A. Testing: Perform the following testing:

1. In accordance with Section 308 of the reference specifications, the contractor shall submit proof in the form of test results from an approved commercial testing laboratory that the materials proposed meet the quality and gradation requirements.

PART 3 - EXECUTION

3.1 Examination

A. Inspect substrates and conditions under which the work of this section will be performed, and verify that installation properly may commence. Do not proceed with the work until unsatisfactory conditions have been resolved fully.

3.2 Application

A. General: Compaction Requirements:

1. Material shall be compacted to minimum depth of six inches and to the following densities in accordance with ASTM D1557-78: subgrade (pavement areas and roadways): 95 percent relative compaction; base course: 95 percent relative compaction.

B. Sub Grade:

1. Subgrade for base course shall be prepared in accordance with the following sections of the reference specification: 302.02, 302.04, 302.05, 302.06.

3.3 Field Quality Control

A. Testing and Inspection: Perform the following field tests:

1. Owner's testing agency shall submit in the form of test results that compaction standards are being achieved as specified.

END OF SECTION 321123

SECTION 321200 - FLEXIBLE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Standard Specifications for Public Works Construction, 2016 Edition, as adopted by the City of Reno.

C. Geotechnical Investigation Report, titled Libby Booth Elementary School Modernization STEAM Building Project by Construction Materials Engineers, Inc. dated February 2026.

1.2 SUMMARY

A. The project requirements for Hot-Mixed Asphalt shall be those specified in Sections:

315 - Prime Coat
316 - Tack Coat
317 - Seal Coats (Fog Seal, Sand Seals, and Chip Seals)
318 - Slurry Seal
320 - Plantmix Bituminous Pavement.
323 - Adjustment of New and Existing Manholes, Catch Basins, Electrical Vaults, Water and Gas Valves to Final Grade.
324 – Painting, Pavement Striping and Marking

of the standard specifications for Public Works Construction, Latest Edition, the contract documents, and Geotechnical Investigation Report, Silver Dollar Elementary School, dated June 10th 2024, prepared by Geotechnical & Environmental Services, Incorporated. the requirements stated herein and the requirements shown on the contract documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall conform to the Geotechnical Investigation Report, Silver Dollar Elementary School, dated June 10th 2024, prepared by Geotechnical & Environmental Services, Incorporated.

B. Site asphalt concrete shall be Type 2 and Type 3. Public roadway asphalt concrete shall be per requirements. The Contractor shall submit an asphalt mix design for approval by the Architect at least 14 days prior to the proposed paving date.

C. Seal Coat: Fog seal consisting of SSI asphaltic emulsion shall be applied to the finished asphalt surface. Immediately remove spilled and splattered materials from adjacent surfaces.

D. Materials shall conform to the plans and Standard Specifications for Public Works Construction, 2012 Editions.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. The project requirements for Flexible Paving shall be those specified in Sections:

315 - Prime Coat
316 - Tack Coat
317 – Seal Coats (Fog Seal, Sand Seals, and Chip Seals)
318 - Slurry Seal
320 - Plantmix Bituminous Pavement
323 – Adjustment of New and Existing Manholes, Catch Basins, Electrical Vaults, Water and Gas Valves to Final Grade.
324 – Painting, Pavement Striping and Marking

of the standard specifications for Public Works Construction and Geotechnical Evaluation Stonebrook Elementary School, dated January 20th 2022, prepared by Geotechnical & Environmental Services, Incorporated.

END OF SECTION 321200

SECTION 321300 -RIGID PAVING

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Standard Specifications for Public Works Construction, 2016 Edition, as adopted by the City of Reno.

C. Geotechnical Investigation Report, titled Libby Booth Elementary School Modernization STEAM Building Project by Construction Materials Engineers, Inc. dated February 2026.

1.2 SUMMARY

A. The project requirements for site concrete shall be those specified in Sections 311 - Concrete Structures and Masonry Construction and 312 - Concrete Curb, Gutters, Walks, Driveways, and Alley Returns of the Standard Specifications for Public Works Construction, Latest Edition, the requirements stated herein and the requirements shown on the contract documents.

PART 2 - PRODUCTS

2.1 Materials

A. Portland Cement Concrete (P.C.C.) shall have the following characteristics: 4000 PSI min compressive strength at 28 days with min. of 6.25 sacks of cement per cubic yard of concrete. Air entertainment shall be 4-7%, slump shall range from 1” min. to 4” max. All materials shall conform to SSPWC Sec. 202. All site concrete shall be reinforced with collated, fibrillated, polypropylene fibers as manufactured by Fibermesh or approved equal. Use 1 1/2 lbs. per cubic yard.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. The project requirements of Sections 311 - Concrete Structures and Masonry Construction and 312 - Concrete Curb, Gutters, Walks, Driveways, and Alley Returns of the Standard Specifications for Public Works Construction, Latest Edition.

END OF SECTION 321300

SECTION 321723 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Standard Specifications for Road and Bridge Construction (Silver Book), 2014 Edition.

1.2 SUMMARY

A. The project requirements for pavement Markings shall be those specified in Section 632 and 729 of the Standard Specifications for Road and Bridge Construction (Silver Book), 2014 Edition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Traffic Paint:

1. Traffic Paint material specifications shall follow section 729 of the Standard Specifications for Road and Bridge Construction (Silver Book), 2014 Edition.
2. Blue: Glidden Traffic Paint, All Stripe Traffic Paint or equal.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. Traffic paint applications shall follow section 632, of the Standard Specification of Road and Bridge Construction (Silver Book), 2014 Edition.

END OF SECTION 321723

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Gates: swing.

B. Related Sections:

1. Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: 6 foot.
2. Steel Wire Fabric: Wire with a diameter of 0.192 inch.
    a. Mesh Size: 2 inches.
    b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.
3. Selvage: Knuckled at both selvages.

2.2 NON-SCALABLE SECURITY CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on drawings.
2. Steel Wire Fabric: 11 gauge wire.
    a. Mesh Size: 5/8 inches.
    b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.
3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: As indicated on Drawings.
2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.
    a. Line Post: 2.375 inches in diameter.
    b. End, Corner and Pull Post: 2.875 inches.
3. Horizontal Framework Members: top rails complying with ASTM F 1043.
    a. Top Rail: 1.66 inches in diameter.
4. Brace Rails: Comply with ASTM F 1043.
5. Metallic Coating for Steel Framing:
    a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.

2.4 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:

1. Type II, zinc coated (galvanized) by electrolytic process, with the following minimum coating weight:

    a. Matching chain-link fabric coating weight.

2.5 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types.

1. Gate Leaf Width: As indicated.
2. Gate Fabric Height: 72 inches or less.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

1. Hinges: 180-degree outward swing.
2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
3. Panic hardware to be Von-Duprin model 99 with keyed cylinder dogging.

2.6 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.

D. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

E. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

F. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Hot-Dip Galvanized Steel: 0.106-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

G. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Where posts are located in asphalt paving areas, extend 2 inches above grade; shape and smooth to shed water.
b. Concealed Concrete: Where posts are located in sidewalk or planter areas, top 2 inches below grade to allow covering with surface material.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more.

D. Line Posts: Space line posts uniformly at 96 inches o.c for fences to receive non-scalable security fabric. Line posts shall be uniformly spaced at 10 foot o.c. where standard fabric is used.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.5 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-

resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION 32 31 13

SECTION 331100-WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. The Echo Loder Elementary School water is supplied from the Truckee Meadows Water Authority (TMWA).

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Standard Specifications for Public Works Construction, 2012 Edition, as adopted by City of Reno.

1.3 CODE COMPLIANCE AND STANDARDS

A. American Water Works Association –AWWA

B. Truckee Meadows Water Authority – TMWA

1.4 QUALITY ASSURANCE

A. All materials shall be certified new from factory. Pipe, fittings, and valves shall be made in the USA or Canada to AWWA and ANSI standards and suitably stamped. Piping components made in other countries shall not be used unless specifically approved in advance by the Project Coordinator.

1. Acceptable suppliers for AWWA C900 and C905 pressure water pipe are:

a) CertainTeed Corporation
b) Diamond Plastics Corporation
c) PW Eagle Inc.
d) Other equal alternates

B. Backflow prevention devices and installations shall conform to all requirements of Truckee Meadows Water Authority.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Contractor shall be responsible for inspecting materials delivered to site for damage.
2. Materials shall be stored on-site in enclosures or under protective coverings.
3. Joint materials, fittings, valves, and gaskets shall be stored under cover out of direct sunlight.

B. Handling:

1. Pipe, fittings, valves and other accessories shall be handled in such a manner as to ensure delivery to the trench in sound, undamaged condition.
2. Special care shall be taken to avoid injury to coatings and linings on pipe and fittings. Damaged coatings and linings shall be repaired by the Contractor to the satisfaction of the Project Coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipes 4 inches and larger:

1. AWWA C900 PVC, Class 235, bell and spigot
2. AWWA C151 ductile iron pipe, cement mortar lined, Class 150

B. Fitting:

1. 4 to 12 inch shall be AWWA C153 ductile iron, 350 psi working pressure, cement motar lined, 1 mill thick exterior petroleum asphaltic coating. Mechanical joints with concrete thrust blocks or Mega-Lug joints with thrust blocks.

C. Polyethylene pipe for water services shall meet the requirements of AWWA C901-88, Pressure Rated for 200 psi.

D. Polyethylene wrap to be used on all ductile iron pipe and fittings per AWWA Standard C105.

E. Valves:

1. Gate valves to be 200 psi working pressure, factory coated, iron body, resilient wedge gate valves. Non-rising stem. Mueller A-60 series, American AVK series 25, or equal.

PART 3 - EXECUTION

3.1 TRENCHING, BACKFILLING AND COMPACTING

A. Trenching:

1. The owner may limit the amount of trench to be opened at any time.
2. Minimum depth from finished grade to top of pipe is 36”.

B. Bedding:

1. Ditch bedding shall be accurately graded with a minimum of six inches (6”) of sand. Sand shall pass a ¼ inch screen with mot more than fifteen percent (15%) passing a No. 200 sieve. Sand shall be backfilled to a minimum of six inches (6”) above the pipe casing. Bedding shall be laid to firmly support the piping along its entire length.

C. Backfilling: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of word permits.

D. Damage Repair: Utilities, wall, piping, and other improvements damaged during the course of work shall be repaired to their original condition or replaced by the contractor.

E. Excess Material: Excess material and debris shall be removed and disposed of at an approved disposal site, within one week after final approval of installation.

3.2 PIPING INSTALLATION

A. Cleaning and disinfection:

1. Reference TMWA Appendix 9C for cleaning and disinfection procedures. Flush line before disinfecting. After disinfection, hydrostatically test piping. Owner must witness flushing, disinfection and hydrostatically testing before acceptance.

3.3 FIELD QUALITY CONTROL

A. The project coordinator or his representative will conduct field inspections and shall witness all field tests specified in this section. The contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. The contractor shall produce evidence, when required by the project coordinator, that any item of work has been constructed properly in accordance with the contract drawings and specifications.

B. Field Test:

1. All anchor blocks and restraints shall be complete prior to testing. Concrete supports shall be fully cured. Disinfection completed. All Joints exposed for testing.
2. Piping Hydrostatic Pressure Tests:

a. Test pressure gauges for a specific test shall have dials indicating not less than one and one half (1-1/2) times nor more than two (2) times the test pressure.
b. After installation of insulation, anchor blocks, and backfill, hydrostatic pressure shall be applied to 150 psig and allowed to stabilize to ground temperature while maintaining 150 psig, +/- 10 psi. After stabilization, pressure source shall be removed. Piping must hold 150 psig, +/- 10 psi, for at least four (4) hours. Leaks shall be repaired and the test repeated if the pressure does not hold.

END OF SECTION 331100

SECTION 333100-SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Standard Specifications for Public Works Construction, 2016 Edition, as adopted by the City of Reno.

C. Geotechnical Investigation Report, titled Libby Booth Elementary School Modernization STEAM Building Project by Construction Materials Engineers, Inc. dated February 2026.

1.2 SUMMARY

A. The project requirements for sanitary sewer shall be those specified in Section 306 – Storm Drain, Culvers, and Sanitary Sewer Construction, of the Standard Specifications for Public Works Construction, Latest Edition, the requirements stated herein and the requirements shown on the contract documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall conform to the Plans and Standard Specifications for Public Works Construction, Latest Edition.

B. PVC pipe to be used for sanitary sewer systems shall meet the requirements of ASTM Specification D-3034, SDR 35 with bell and spigot type rubber-gasket joint.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. The requirements of Section 306 – Storm Drain, Culverts, and Sanitary Sewer Construction, of the Standard Specifications for Public Works Construction, 2016 edition, shall be incorporated into and made part of the project contract documents.

B. Sanitary sewer pipe, 8” and larger, and manholes shall be pressure tested as follows. Pressure testing of storm drain or storm drain manholes will not be required.

1. Sanitary Sewer Piping Air Test:

a. Each section of sewer shall be tested between manholes by plugging and bracing all openings in the main line and the upper ends of all service lateral connections. Prior to any air pressure testing, all pipe plugs shall be checked with soap solution to detect any air leakage. If any leaks are found, the air pressure shall be released, the leaks eliminated and the test procedure started over.

b. Air shall be introduced into the pipeline until 3.0 p.s.i. gauge pressure has been reached, at which time the flow of air shall be reduced and the internal pressure shall be maintained between 2.5 and 3.5 p.s.i. for at least 2 minutes to allow the air temperature to come to equilibrium with the temperature of the pipe walls. Pressure in the pipe shall be constantly monitored by a gauge and hose arrangement separate from the hose used to introduce air into the line. Pressure in the pipe shall not be allowed to exceed 5 psi.
c. After the temperature has stabilized and no air leaks at the pugs have been found, the air pressure shall be permitted to drop to 2.5 p.s.i. When the internal pressure has reached 2.5 p.s.i., the line shall be disconnected from the air source and a stop watch or sweep-second-had watch shall be used to determine the time lapse required for the air pressure to drop to 1.5 p.s.i. If the time lapse required for the air pressure to decrease from 2.5 p.s.i. to 1.5 p.s.i. exceeds the follow times, based on sewer pipe size, the pipe shall be presumed to be within acceptable limits for leakage:

    1) 8” sanitary sewer pipe: 2.5 minutes
    2) 10” sanitary sewer pipe: 3.0 minutes
    3) 12” sanitary sewer pipe: 3.5 minutes
    4) 15” sanitary sewer pipe: 4.5 minutes
    5) 18” sanitary sewer pipe: 5.5 minutes

d. If any section of pipe does not pass the pressure test, leaks shall be repaired and the test repeated.

2. Each new sanitary sewer manhole shall be tested for leakage using a vacuum test method conforming to ASTM test method C 1244.

END OF SECTION 333100

SECTION 334100-STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Standard Specifications for Public Works Construction, 2016 Edition, as adopted by the City of Reno.

C. Geotechnical Investigation Report, titled Libby Booth Elementary School Modernization STEAM Building Project by Construction Materials Engineers, Inc. dated February 2026.

1.2 SUMMARY

A. The project requirements for storm utility drainage piping shall be those specified in Section 306 – Storm Drain, Culverts, and Sanitary Sewer Construction, of the Standard Specifications for Public Works Construction, latest edition, the requirements stated herein and the requirements shown on the contract documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall conform to the Plans and Standard Specifications for Public Works Construction, Latest Edition.

B. PVC pipe to be used for storm utility drainage piping systems shall meet the requirements of ASTM Specification D-3034, SDR 35 with bell and spigot type rubber-gasket joint.

C. Ductile iron pipe used for storm utility drainage piping shall meet the requirements of ANSI/AWWA C151/A21.51, Pressure Class 150. Ductile iron pipe shall be poly encased per ANSI/AWWA C105, Method A.

D. Corrugated high density polyethylene (CHDPE) pipe ASTM specification D-3350 Type S (smooth interior lining)

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. The requirements of Section 306 – Storm Drain, Culverts, and Sanitary Sewer Construction, of the Standard Specifications for Public Works Construction, Latest Edition, shall be incorporated into and made part of the project contract documents.

END OF SECTION 334100

Technical Specifications
Volume 1

Libby Booth Elementary School Tenant Improvements

100% Construction Documents
August 28, 2026

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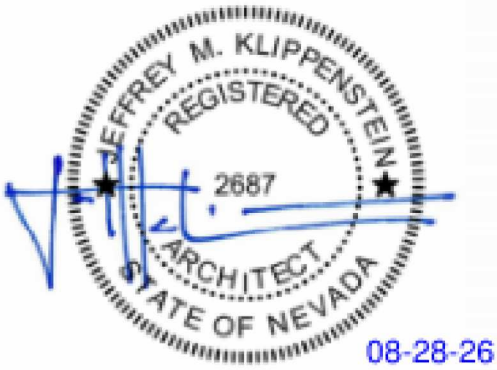
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SECTION 00 00 01 – PROJECT DIRECTORY

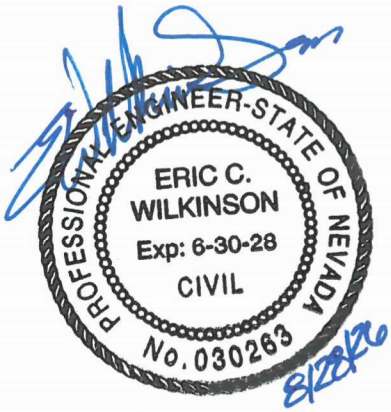
August 28, 2026

OWNER
Washoe County School District
Capital Projects and Planning
14101 Old Virginia Road
Reno, NV 89521
(775) 789-3840

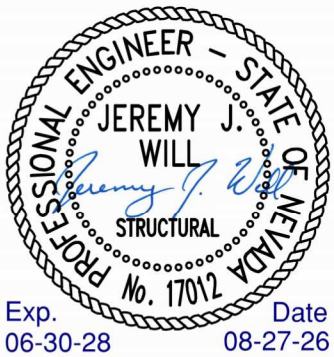
ARCHITECTURE
H+K Architects Ltd.
Jeff Klippenstein, AIA
50 Washington Street #200
Reno, NV 89503
(775) 332-6640



CIVIL ENGINEERING
Odyssey Engineering
Eric Wilkinson, P.E.
895 Roberta Lane, Suite 104
Sparks, NV 89431
(775) 359-3303



STRUCTURAL ENGINEERING
Will Engineering, LLC
Jeremy Will, S.E.
748 S. Meadows Pkwy, Suite A-9
PMB #21
Reno, NV 89521
(775) 560-6554



Exp. 06-30-28 Date 08-27-26

MECHANICAL ENGINEERING

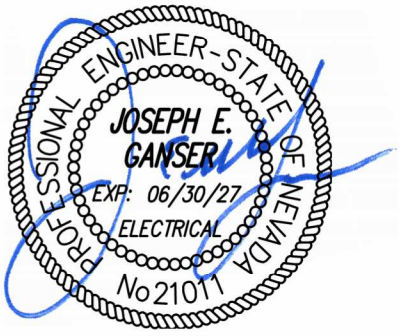
Ainsworth Associates
Alison Hall, P.E., LEED AP BD+C, CPD
1420 Holcomb Ave., Suite 201
Reno, NV 89502
(775) 329-9100



08/27/2026

ELECTRICAL ENGINEERING

PK Electrical, Inc.
Joey Ganser, P.E.
681 Sierra Rose Drive, Suite B Reno, NV 89511
(775) 826-9010



08/27/2026

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NOT USED

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NOT USED

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NOT USED

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NOT USED

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NOT USED

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NOT USED

END OF SECTION 00 00 10

SECTION 01 81 00 – SUPPORT AND LATERAL FORCE RESTRAINT OF NON-STRUCTURAL COMPONENTS, UTILITIES, AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide engineered vertical support and lateral restraint for non-structural systems supported by the structure including but not limited to Architectural Components, Fire Suppression Piping and Equipment, Electrical Equipment, Electrical Raceway, Plumbing Piping and Equipment, Mechanical Piping, Process Piping, HVAC Duct, Mechanical Equipment, Mechanical Curbs, and utilities in compliance with the currently adopted version of the International Building Code (IBC) and with local building code amendments.

B. At vertical support and lateral restraint installation locations, provide structural systems engineered to accommodate dead load, live load, seismic force, and wind force reactions.

1.2 RELATED SPECIFICATION SECTIONS

Division 11: Equipment
Division 13: Special Construction
Division 21: Fire Suppression
Division 22: Plumbing
Division 23: Heating Ventilation and Air Conditioning
Division 26: Electrical

1.3 REFERENCES

A. Publications, codes, and standards listed below form a part of this specification to the extent referenced.

1. Currently adopted version of the International Building Code (IBC)
   Chapter 16 - Structural Design,
   Chapter 17 – Structural Tests And Special Inspections
2. ASCE 7-22, Minimum Design Loads For Buildings and Other Structures, American Society of Civil Engineers (ASCE).
3. ACI 318, Building Code Requirements for Structural Concrete, American Concrete Institute (ACI).

1.4 COMPONENT IMPORTANCE FACTOR

A. Components shall be assigned a component importance factor, I_p, in accordance with ASCE 7, Chapter 13.

1.5 SUBMITTALS

A. Provide Dead and Live Load calculations as required by ASCE 7-22 and the equipment manufacturer stamped by a registered civil or structural engineer licensed to practice in Nevada.

B. Provide Wind and Seismic Design Force calculations per ASCE 7-22 stamped by a registered civil or structural engineer licensed to practice in Nevada.

C. Submit vertical support and lateral restraint plans stamped by a registered civil or structural engineer licensed to practice in Nevada. Plans to show:

1. All vertical support, anchorage for wind and seismic, and brace locations.
2. All vertical support and anchorage connections to structure including anchor brand, type, quantity, and size.
3. Vertical support and brace reaction point load at all connections to structure for review by engineer of record in checking suitability of the building structure to accommodate imposed loads.
4. Plan sheets showing appropriate installation details reflecting actual job site conditions.
5. Maximum Allowable Size or Equipment/Utility Weight (lbs, lbs/lf).
6. Minimum Vertical Support Size and Material (Steel Grade, Rod Diameter, Strap Width and Gauge, etc).
7. Vertical Support Total Vertical Load.
8. Supplemental framing materials, sizes, locations (strut, angles, etc.) and method of attachment.
9. Maximum Allowable Transverse Brace Spacing.
10. Transverse Brace Reaction.
11. Maximum Allowable Longitudinal Brace Spacing.
12. Longitudinal Brace Reaction.
13. Minimum Required Seismic Restraint Brace Arm Assembly.
14. Minimum Required Seismic Restraint Anchorage Structure.
15. Installation Detail Drawing References.

PART 2 - PRODUCTS

2.1 CODE APPROVALS

A. Anchorage and support products shall have ICC or equivalent approval for use under the conditions, exposure, load type, force magnitude, and substrate in which they shall be used.

B. Anchorage products in concrete shall be approved for use in cracked concrete as required by ACI 318.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Supports, restraint, and anchorages to be per the approved submittals and product manufacturer requirements.

3.2 EQUIPMENT CONNECTIONS

A. Components crossing structural joints, where relative movement due to wind or seismic forces may occur, shall include movement joints designed to accommodate movement defined by ASCE 7, and as delineated in the Construction Documents.

3.3 SPECIAL INSPECTION

A. Special Inspection Requirements:

All Designated Seismic Systems are subject to Special Inspection per IBC Chapter 17. The Lateral Force Restraint Engineer shall provide a special inspection plan to the Contractor for submittal to the Owner and Design Team for use by the project's Special Inspector. The plan will include the following:

1. A list of all components of the vertical support seismic system that require inspection or testing.
2. The required frequency of testing and inspection.
3. Type and nature of testing required.

B. Special inspection for mechanical and electrical components shall be provided as follows:

1. For all Designated Seismic Systems within seismic design categories D, E or F.
2. Periodic special inspection during the anchorage of electrical equipment for emergency or standby power systems in structures assigned to Seismic Design Categories C, D, E or F.
3. Periodic special inspection during the installation of anchorage of all other electrical equipment in Seismic Design Categories E or F.
4. Periodic special inspection during the installation for flammable, combustible or highly toxic piping systems and their associated mechanical units in Seismic Design Categories C, D, E or F.
5. Periodic special inspection during the installation of HVAC ductwork that will contain hazardous materials in Seismic Design Categories C, D, E or F.
6. Periodic special inspection during the installation of vibration isolation systems where the construction documents indicate a maximum clearance (air gap) between the equipment support frame and restraint less than or equal to 1/4 inch.

C. Install identification tags at all seismic brace locations. Tags to include the following information:

1. Specific seismic forces the location was designed to resist.
2. Maximum brace reaction at connection to structure.
3. For single hung items, the maximum pipe/conduit size the brace location was designed to accommodate.
4. For trapeze supported items, the maximum weight (lbs/lf) the brace location was designed to accommodate.
5. For suspended equipment, the maximum unit operating weight (lbs) the brace location was designed to accommodate.
6. Location identifier cross matched to that on plan set layout.
7. Company name of installing contractor.

D. Upon completion of construction, a Quality Assurance Representative of the Lateral Force Restraint Engineer shall review the installation of the seismic-force-resisting system and provide documentation indicating general conformance to seismic restraint layout drawing.

END OF SECTION 01 8 100

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 01 10 00 - "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 01 73 00 - "Execution" for cutting and patching procedures.
3. Section 01 35 16 - "Alteration Project Procedures" for general protection and work procedures for alteration projects.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse [**store**].

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 01 32 33 - "Photographic Documentation." Submit before Work begins.

1.6 CLOSEOUT SUBMITTALS

1.7 QUALITY ASSURANCE

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 - "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 3 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 - "Construction Waste Management and Disposal."

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 01 74 19 - “Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 02 41 26 – SELECTIVE ELECTRICAL DEMOLITION

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.
   2. Disposal of materials.
   3. Storage of removed materials.
   4. Identification of utilities.
   5. Salvaged items.
   6. Protection of items remain as indicated on Drawings.
   7. Relocate existing equipment to accommodate construction.

1.2 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of temporary work. Describe demolition removal procedures and schedule.

1.3 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of capped utilities, conduits and equipment abandoned in place.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Washoe County School District's (WCSD) standard.

1.5 PRE-INSTALLATION MEETINGS

A. General Conditions: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.6 SEQUENCING

A. General Conditions: Requirements for sequencing.

B. Sequence as requested for project.

1.7 SCHEDULING

A. General Conditions: Requirements for scheduling.

B. Schedule work to coincide with new construction or remodeled/ renovation area.

C. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.8 COORDINATION

A. General Conditions: Requirements for coordination.

B. Conduct demolition to minimize interference with adjacent and occupied building areas.

C. Coordinate demolition work with General Contractor.

D. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

E. Shut-down Periods:
1. Arrange timing of shut-down periods of in service panels with Owner. Do not shut down any utility without prior written approval.
2. Keep shut-down period to minimum or use intermittent period as directed by Owner.
3. Maintain life-safety systems in full operation in occupied facilities, or provide notice minimum 3 days in advance.
4. Provide temporary power to equipment or panelboards as requested by the owner during any planned building outages to facilitate the new work required.

F. Identify salvage items in cooperation with Owner.

1.9 CONTRACTOR'S USE OF PREMISES

A. Confine operations at site to areas and limits permitted by law, ordinances, permits; contract documents and general conditions.

B. Protection and safekeeping of products stored on premises is responsibility of contractor supplying product.

C. Deliveries and unloading shall be scheduled to prevent traffic congestion blocking of access or interference with work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.

D. Contractor shall pay for, or satisfactorily repair, all damages incident to their work, to sidewalks, streets, other public or private property, or to any public utilities occurring during period of work under this contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

A. General Conditions: Verification of existing conditions before starting work.

B. Visit site and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the electrical work, including relocation of existing services and utilities on building site in bid. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference shall be reported immediately to the consultant.

C. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

D. Verify termination points for demolished services.

3.2 PREPARATION

A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

B. Temporary egress signage and emergency lighting

3.3 DEMOLITION

A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation. Demolish existing electrical work, including auxiliary systems, in areas of existing building shown reworked. Coordinate removal of electrical systems with General Contractor and Owner.

B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors , and patch surfaces.

C. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

D. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

E. Reconnect equipment being disturbed by renovation work and required for continue service to nearest available panel.

F. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.

G. Install temporary wiring and connections to maintain existing systems in service during construction.

H. Perform work on energized equipment or circuits with experienced and trained personnel.

I. Remove, relocate, and extend existing installations to accommodate new construction.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.

L. Clean and repair existing equipment to remain or to be reinstalled.

M. Protect and retain power to existing active equipment remaining.

N. Cap abandoned empty conduit at both ends.

O. In reworked areas, remove all electrical equipment; i.e.: Light fixtures, panelboards, switches, receptacles, auxiliary system devices, telephone outlets, etc.; unless otherwise noted. Remove existing branch circuits (conduit, wire, outlet boxes and supports) serving equipment to be removed. Abandon circuits concealed in concrete. Remove conductors from abandoned conduits. Leave existing branch circuits and feeders which run through reworked areas and serve existing equipment to remain in service, continuous and uninterrupted. Repair, re-terminate, re-support, etc., any damaged circuits, feeders or supports.

P. Abandon outlets in existing masonry and brick walls: provide blank stainless steel cover plates.

Q. Cut off abandoned conduits concealed in slab one inch below top of base floor slab and patch slab or floor to match existing.

3.4 EXISTING PANELBOARDS

A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.

B. Tag unused circuits as spare.

C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.

D. Remove existing wire no longer in use from panel to equipment.

E. Provide new updated panel directories within panelboards where any circuit has been modified or rewired. Pen markings are not acceptable.

3.5 SALVAGE ITEMS

A. Electrical equipment, wiring, etc., removed and not required to be part of new electrical installation is classed as salvage.

B. The Contractor shall submit a list of salvageable equipment and/or parts identified below that are to be removed. Provide list to Owner for review.

C. The list shall contain the following:
   1. type of equipment
   2. quantity
   3. manufacturer
   4. model #
   5. condition (with explanation if needed)

D. Once the list has been reviewed the Contractor will be notified of any equipment deemed reusable by the Owner.

E. Salvageable equipment not selected to be retained by the Owner becomes property of Contractor. Remove from job site.

3.6 REUSABLE ELECTRICAL EQUIPMENT

A. Carefully remove equipment, materials, or fixtures which are to be reused.

B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

C. Relocate existing lighting fixtures as indicated on Drawings. Clean fixtures and re-lamp. Test fixture to see if it is in good working condition before installation at new location.

3.7 CUTTING AND REPAIRING

A. Cut and repair walls floors, roof, etc., as required for installation of work in this Division. Employ professional installers of repair materials where repair work is major or aesthetics are of primary importance.

B. Do not pierce exterior walls below grade with hanger bolts. Do not cut building structural members except where accepted by Engineer. Do not use core drilling as a cutting method above telephone, electrical or data equipment. Use hammer drill only (size limited). Contain water below floor at any location of core drilling. Locate final holes to avoid cutting existing rebar as much as possible.

C. Repair work shall be comparable with work cut. New finishes shall match adjacent finishes. Engineer will review repaired work and may reject unsuitable work.

3.8 HAZARDOUS MATERIALS

A. Submit Material Safety Data Sheets for all materials furnished in this project defined as hazardous by NFPA. All requirements of the Material Safety Data Sheets shall be implemented and followed judiciously when hazardous materials are installed or otherwise used.

B. All hazardous materials shall be stored and used (mixed, applied, etc.) in strict accordance with the OSHA Standards, and Safety Data Sheets.

3.9 WELDING AND CUTTING

A. Special precautions shall be taken to reduce fire hazards where electric or gas welding or cutting work or soldering is done and suitable fire extinguishing equipment shall be maintained near such operations.

3.10 CLEANING

A. General Conditions: Requirements for cleaning.

B. Remove demolished materials as work progresses. Legally dispose.

C. Keep workplace neat.

3.11 PROTECTION OF FINISHED WORK

A. General Conditions: Requirements for protecting finished Work.

B. Do not permit traffic over unprotected floor surface.

3.12 DISPOSAL PROCEDURES (FLUORESCENT BULBS, BALLASTS & LIGHT FIXTURES)

A. These materials do not require special training to remove or package.

B. The Contractor shall contract with Waste Management LampTracker to recycle the lamps (fluorescent bulbs) and ballasts removed during the project. The costs to recycle these materials is the responsibility of the contractor. The disposal and costs of non-regulated materials (light fixtures) is the responsibility of the Contractor. The Contractor is required to recycle as much material as possible.

C. LAMPS

1. The lamps contain mercury and are required to be properly recycled. If the lamps were crushed they would no longer be classified as regulated waste but would be hazardous waste which is not permitted.
2. The removed lamps are to be placed into boxes obtained from LampTracker for recycling. The box is to be closed with clear packing tape. The box is required to also meet the following additional requirements.
   a. Each box is to be properly closed with clear tape.
   b. The boxes are to be placed on a pallet and shrink-wrapped.
   c. 4 foot lamps boxes are not to be stacked higher than 66 inches.
   d. 8 foot lambs boxes are not to be stacked higher than 48 inches.
   e. Each box is to be properly labeled per the labeling section in this document.
3. The Contractor is required to protect the boxes from the weather. If the boxes become wet for any reason, the Contractor is required to replace the boxes at no cost to UNR.
4. The recycling facility will not take boxes that have indications that they may have leaked materials. Water stained boxes cannot be accepted.
5. The Contractor is required to use proper packing and arrange for picking by Waste Management.

D. BROKEN LAMPS

1. The Contractor is to minimize lamp breakage. However, if breakage does occur and the majority (75%) of the bulb is still intact, place this portion in the lamp boxes for recycling. The smaller pieces are to be swept up and placed into a sealable 5 gallon bucket. The pieces are not to be vacuumed.
2. Broken lamp buckets are required to be labeled per the Labeling Section in this document.

E. BALLAST RECYCLING

1. The Contractor is to separate the ballasts into two types: ballasts with the “NO PCBs” label, and ballast that do not contain the label. Contractor shall order the appropriate size containers depending on the quantity of ballasts. The Contractor properly package and arrange for pickup by Waste Management. The containers are required to be properly labeled, placed on pallets, shrink wrapped and cannot exceed 700 pounds.

F. LABELING

1. The Contractor is required to place a label on all containers/boxes. The label must be accurate and visible once placed on the pallet for shipping. The labels can be pre-printed by the Contractor with the date and number of units in each container marked in the field. If the number of units is not correct and the recycling facility determines that the shipment is not acceptable and returns delivery, the Contractor is responsible for all charges to correct.
2. The following are the requirements for all labels.
   a. Lamps
      Universal Waste/Used Mercury Lamps for Recycling
      Date: _____ Number of Units: _____
      Location: Building Name: Street Address, City and State
   b. Broken Lamps
      Broken Universal Waste/Used Mercury Lamps for Recycling
      Date: _____ Number of Units: _____
      Location: Building Name: Street Address, City and State
   c. Non-PCB Ballast
      Non-PCB Ballast for Recycling
      Date: _____ Number of Units: _____
      Location: Building Name: Street Address, City and State
   d. PCB Ballast
      PCB Ballast for Recycling
      Date: _____ Number of Units: _____
      Location: Building Name: Street Address, City and State

END OF SECTION 02 41 26

SECTION 03 10 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Requirements:

1. Drawings and general provisions of the Contract Documents including General, Special and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. General Scope of Work:

1. Provide formwork and accessories in accordance with provisions of this Section for cast-in-place concrete shown on the Drawings or required by other Sections of these Specifications.

C. Related work:

1. Section 03 20 00: Concrete reinforcement.
2. Section 03 30 00: Cast-in-place concrete.
3. Section 03 45 00: Concrete Finishing.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Design of formwork is the Contractor's responsibility.

C. Standards:

1. Concrete work shall comply with the requirements of ACI 301, “Specifications for Structural Concrete for Buildings”, latest edition.
2. Items not otherwise specified shall comply with ACI Standard 347, “Recommended Practice for Concrete Formwork”, latest edition.

D. Allowable Tolerances in Formwork:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347.
2. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
3. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.
4. Refer to Structural Drawings for additional requirements.

E. Inspections:

1. See drawings and general provisions of the Contract Documents including General, Special and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.
2. See requirements for inspection as stated in Part 3 of this section.

1.3 SUBMITTALS

A. Submit manufacturer’s specifications and installation instructions for products specified. Include manufacturer’s certification as may be required to show compliance with these specifications.

1.4 JOB CONDITIONS

A. LOADING STRUCTURES

1. Protect all in-place structures from excessive loading.
2. Shore and brace as necessary to prevent all damage.

B. SCHEDULING

1. Contractor shall provide and erect sufficient forms so that the work of placing concrete will proceed at a rate to insure maintaining a schedule so that the time of the inspector shall be as continuous as practicable.

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL

1. Except for metal forms, use new materials. Materials may be re-used during progress of the Work, provided they are completely cleaned and reconditioned, recoated for each use, and capable of producing formwork of the required quality.

B. EARTH FORMS

1. Side forms for footings may be omitted, and concrete may be placed directly against excavation, only when requested by Contractor and approved by Architect, in writing. The Architect shall be the sole authority for making this approval.
2. When omission of forms is accepted, provide additional concrete 1” on each side of the minimum design profiles and dimensions shown on Structural Drawings.

C. FORM MATERIALS

1. Plywood:
   a. APA Exterior “B-B” “Plyform” grade Douglas Fir veneer panel with medium density overlaid one side grade; sound, undamaged sheets with clean, true edges; conform to Product Standard PS 1. Use for all exposed concrete surfaces.

b. Panel thickness and placing as required to support concrete in accordance with referenced standards; minimum ¾" thickness.
c. All panels edge sealed; Both faces of general use panels shall be factory sealed with colorless coating which will not affect application of applied finishes or protective coatings; form oil not permitted.

2. Lumber for Forms:
   a. For concealed concrete surfaces including footings and foundations, use "Standard" or better grade Douglas Fir, T&G or shiplap, surface 1 side, 2 edges, not wider than 8", secured to wood or steel stakes, substantially constructed to shapes indicated and to support the required loads.
   b. For studs, wales, and supports, use S4S surfaced "Standard" or better grade Douglas Fir lumber, dimensions as required to support the loads, but not less than 2x4 inch size.
3. Flat Steel Forms:
   a. Approved type steel forms may be used in lieu of wood and plywood, at the Contractor's option.
4. Tube Forms:
   a. For round columns furnish fiber, fiberglass, or metal tube forms of diameters required, capable of withstanding continuous pour full height and providing a finished surface free of spiral markings.

B. ACCESSORIES

1. Form Ties:
   a. Removable form bolts with coil ties, or snap ties.
   b. Either system shall have cone spreaders and tie metal shall be ¾" minimum back of concrete face.
   c. As manufactured by Superior Concrete Accessories, Burke, Richmond, or equal.
2. Screed Chairs:
   a. Approved type for slab screeds.
3. Chamfer Strips:
   a. Wood or PVC strips, ¾ x ¾ inch size of maximum possible lengths.
4. Control Joints:
   a. For interior slabs, provide by sawcutting.
   b. Where specified by the Architect, furnish cast-in-place control joints: Greenstreak Plastic Products "Zipcap Control-joint Former, W.R. Meadows SPEED-E-JOINT, or equal, minimum 10-foot lengths, 1" depth for installation in new interior slabs.
5. Expansion Joints:
   a. For Interior Slabs: ½" thick by depth of slab less ¼", conforming to ASTM D1752, Type 3 (AASHTO M153-Type II), Meadows "Seal Tight" self-expanding cork, A.P.S Self-Expanding Cork, or equal.
6. Waterstops:
   a. Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50° F to plus 175° F working temperature range, 4" wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; Greenstreak, J.P. Specialties Earth Shield, or equal.
7. Nails, Spikes, Lag Bolts, Thru-Bolts, Anchorages:
   a. Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
8. Joint Sealant:
   a. As specified in Section 03 30 00.
9. Form Saver Splices:

a. Form saver splices shall develop 125% of the specified yield strength of the bar being spliced and shall be Dayton Superior D51A with D51 threaded bar, nVent Lenton Form Saver, or equal.

E. TREATMENT OF FORMS

1. Furnish W. R. Meadows, Inc. “Sealtight Duogard”, Nox-crete Chemical “Nox-crete Form Coating”, or equal, guaranteed as non-staining and not impairing bond of paints or other coatings.
2. Form release agent may be factory-applied provided release agent conforms to these requirements; form oil not permitted.

2.2 DESIGN OF FORMWORK

A. General:

1. Design formwork so it will safely support vertical and lateral loads that might be applied. Design forms and falsework to include factors pertinent to safety of the structure during construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

B. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Install concrete work in accordance with ACI 301 except as amended by this Section.

B. Earth Forms:

1. Where permitted, hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete. Provide additional concrete 1” on each side of the minimum footing dimensions shown on the Structural Drawings.

C. Construction - Formwork:

1. General:
   a. Construct formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 347. Construct so concrete members and structures are of correct sizes, shapes, lines, and dimensions shown, and as

required to obtain accurate alignment, location, grades, level, and plumb work in the finished structure.

b. Make reasonably tight to prevent excess leakage of cement paste during concrete placement. Solidly butt joints, and provide backup material at joints as required to prevent leakage and prevent fins. Provide bracing to ensure stability of formwork.
c. Shore or strengthen formwork subject to over-stressing by construction loads.
d. Shoring is required for any reinforced concrete structural component, except concrete slabs supported by structural steel framing U.N.O.
e. Set form board and plywood for walls horizontally; keep form joints to a minimum.
f. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features as required.
g. Remove debris and clean out forms before pouring any concrete.
h. Keep forms moist prior to pour to prevent shrinkage and warping.
i. Do not damage concrete during stripping. Permit removal of remaining principal shores.

2. Fabrication:
   a. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
   b. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
   c. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
   d. Locate studs and joists not farther apart than 12 inches o.c. Horizontal form wales spaced not to exceed 2 feet o.c.
3. Form Ties:
   a. Hold inner and outer forms for vertical concrete together with combination steel ties and spreaders as approved by Architect.
   b. Space wall form ties not over 4 feet apart horizontally and 2 feet apart vertically. Space ties symmetrically in tiers and rows, each tier plumb from top to bottom and each row level. Form tie placement in formed walls where wall surface will be left exposed in the finished work, shall be uniformly spaced and aligned within the following tolerance:
      1) Tie alignment, horizontally and vertically along each wall plane, shall occur no more than ¼” from a straight line measured between first and last tie along any line, and no more than ¼” variance in alignment between any to adjacent ties.
   c. At horizontal pour lines, locate ties not more than 6” below the pour lines. Tighten after concrete has set and before the next pour is made.
   d. For exposed concrete surfaces, install form ties of removable type with she-bolts equipped with permanent plugs and a system approved by Architect for fixing the plug in place.
4. Forms for Exposed Concrete:
   a. Drill forms to suit ties being used, and to prevent leakage of cement paste around the holes. Do not splinter forms by driving ties through improperly prepared holes.
   b. Provide sharp clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
   c. Use extra studs, wales, and bracing to prevent objectionable bowing of forms between studs, and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.
5. Column Forms:
   a. For square or rectangular columns, use 2” thick planks or joists, surfaced one side and two edges; or use metal forms.

b. For round columns, use tube forms as specified above, which will impart a smooth architectural finish as directed and approved by Architect.
c. Construct column forms with tight joints and securely clamped together with steel clamps.

6. Corner treatment:
   a. Chamfer salient corners in exposed concrete unless otherwise noted or where flush with adjacent surfaces. Unless shown otherwise, form chamfers with 3/4" x 3/4" strips, accurately formed and surfaced to produce uniformly straight lines and tight edges.
   b. Extend terminal edges to required limit and miter the chamfer strips at changes in direction.
7. Provisions for Other Trades:
   a. Provide openings in concrete formwork to accommodate work of other trades.
   b. Verify size and location of openings, recesses, and chases with the trade requiring such items.
   c. Accurately place and securely support items to be built into the concrete.
8. Re-use of Plywood:
   a. Plywood forms may be reused provided damaged edges are removed, imperfections in faces are repaired and holes filled and plywood is cleaned to obtain concrete surfaces equal to that obtained by new plywood.

D. TREATMENT OF FORMS

1. Before placing the concrete, the contact surfaces of forms shall be coated with a suitable non-staining form coating compound or shall be given two coats of nitrocellulose lacquer. Mineral oil shall not be used on forms.
2. Excess coating shall be removed by wiping with cloths. Re-used forms shall have the contact surfaces cleaned thoroughly, those which have been coated shall be given an additional application of the coating.
3. Apply form coating material in strict accordance with manufacturer’s recommendations.

E. MISCELLANEOUS EMBEDDED ITEMS

1. Anchor Bolts:
   a. Set as required on the drawings.
2. Inserts, Sleeves, Conduit and Similar:
   a. Allow all trades time and facilities to install.
   b. Conform to Section 503 of ACI Building Code and the International Building Code.
   c. General Contractor shall furnish and install all sleeves and frames for openings shown on drawings or required for equipment, except those sleeves specified under the Mechanical and Electrical Work.
3. CIP Hanger and Connector Inserts:
   a. Install per Manufacturer and Code Report requirements.
4. Hangers for Suspended Ceilings:
   a. Install pigtail hangers consisting of No. 8 galvanized wire with two loops turned on end and embedded 1-1/2” in concrete, for suspended ceiling system specified in Division 9.
   b. Contractor may submit alternate types of anchors for embedding in concrete to Architect for approval.
   c. Particular care is required in location of hangers to preserve module throughout.
5. Elevator Inserts:
   a. Set inserts for rail bracket supports; furnished by elevator subcontractor.
6. Ceiling and Wall Inserts:

a. Exact locations and alignment essential.
b. Drill forms for inserts; install with bolts and washers.
c. Bolt through form into inserts.

7. All Other Miscellaneous Items:
   a. Build-in items specified in other Sections exactly where shown.
   b. Verify locations which may be critical.

F. JOINTS AND STOPPAGES

1. Construction Joints:
   a. Install in accordance with ACI 318 and as specified herein. Located where indicated or otherwise required and approved as to not impair strength of structure.
   b. Provide nominal ¾" x 2-1/2" key at construction joints, unless otherwise shown on drawings, or as directed by Structural Engineer.
   c. Make joints perpendicular to principal reinforcement. Continue half reinforcement and mesh across joints except at isolation joints; provide longitudinal keys at least 1-1/2" deep at all joints in walls and between walls and slabs or footings.
   d. Remove key-forming wood inserts and thoroughly clean surface of concrete at all joints, removing all laitance, before placing next lift.
   e. Immediately prior to placing next lift and/or adjacent slab, dampen hardened concrete of joint surface and coat with neat cement mortar of similar proportions to mortar in concrete.
2. Expansion Joints:
   a. Do not extend reinforcement through where bonded on both sides of joint; smooth dowels may extend through joint. Position accurately and support against displacement in locations listed hereinafter.
   b. Interior Work:
      1) Install isolation/expansion joints between interior ground-supported slabs and building foundation walls when shown on Drawings, and at other locations where specifically shown or noted.
      2) Install joints with top surface recessed below finish elevation ¼", and fill with joint sealer as specified in Section 03 30 00, finished flush with slab surface.
   c. Exterior Work:
      1) Install as required in new walks and slabs in locations and/or spacings shown, elsewhere not more than 10 feet apart. Coordinate exact locations and alignment with Architect.
      2) Install expansion joints between concrete walks/slabs and vertical building walls and retaining walls.
      3) Install at all other locations indicated.
      4) Install joints with top surface recessed below finish elevation ¼", and fill with joint sealer as specified in Section 03 30 00, finished flush with slab surface.
3. Control Joints:
   a. Provide as detailed and in locations indicated, accurately placed to true straight lines and supported against displacement.
   b. For exterior work, form with edging tool as specified in Section 03 30 00.
   c. For interior work, build control strips into forms, install tooled joints, or diamond-saw cut joints 1/8" wide by 1/5 the depth of the slab.
      1) If saw cut method is used, saw cutting shall be performed as soon as the concrete hardens sufficiently to prevent raveling of the concrete at the edges and before the concrete temperature is permitted to fall; perform cuts 4 – 8 hours after concrete is placed, as soon as the freshly placed concrete can be walked on.

2) Contractor shall have at least one spare saw available during the saw cutting operation.

G. REMOVING FORMS AND SHORING

Conform to the following, unless specified otherwise in Structural Notes.

1. Ties:
   a. Remove 4 days after pour. Fill holes with dry pack cement mortar as specified in Section 03 30 00.
2. Forms:
   a. Remove only after concrete has thoroughly hardened. Vertical forms may be removed 24 hours after pour where structure is supported on shores. Remove other forms no sooner than 7 days.
3. Shoring:
   a. Remove shoring only on approval of Structural Engineer but not before concrete has attained the full specified 28-day compressive strength.
   b. Shoring for beams and slabs shall remain in place at all ties until all concrete work over has been completed; if necessary to remove any shoring in order to remove plywood forms, shoring so removed shall immediately be reinstalled to support all loads.
4. Finished Surfaces:
   a. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged, and that corners are true, sharp, and unbroken.
   b. Release sleeve nuts or clamps, and pull the form ties neatly.
   c. Do not permit steel spreaders, form ties, or other metal to project from, or be visible on, any concrete surface except where so shown on Drawings.

3.3 FIELD QUALITY CONTROL

A. INSPECTIONS

1. Testing will be performed as required by International Building Code, as adopted by local jurisdiction, and these Specifications.
2. Inspections of formwork shall include configuration, form, and steel cleanliness.
3. Inspect erected formwork for conformance with approved drawings, for design and seal of form joints, and for type and location of form ties.

END OF SECTION 03 10 00

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Drawings and general provisions of the Contract Documents including General, Supplemental and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. Related work:

1. Section 03 10 00: Concrete formwork.
2. Section 03 30 00: Cast-in-place concrete.

1.2 QUALITY ASSURANCE

A. Comply with the pertinent provisions of the latest edition of the following, except as may be modified herein.

1. ACI 318 “Building Code Requirements for Reinforced Concrete”, hereinafter called “ACI 318”.
2. ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”, hereinafter called “ACI 315”.
3. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

B. Inspections: Drawings and general provisions of the Contract Documents including General, Supplemental and other Conditions and Division 1.

C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.

1.3 SUBMITTALS

A. SHOP DRAWINGS

1. The Contractor shall submit to the Architect, for review, complete and reviewed, reinforcing steel bending and placing diagrams prepared by or under the supervision of a qualified steel detailer; prepare in accordance with ACI 315.
2. Shop drawings shall show details, dimensions and schedules for the fabrication and placing of reinforcing and accessories. Fabrication of items shown in shop drawings shall not begin until Architect has completed his review.
3. Include materials list of items proposed to be provided under this Section, together with manufacturer’s specifications and other data needed to prove compliance with specified requirements.
4. Shop drawings are interpretations of and are supplemental to the design drawings and specifications. Their intent is to demonstrate to the Architect that this Contractor has understood the design concept, and to provide the detailed information necessary for the fabrication, assembly and installation of the products or materials specified. Neither the shop drawings nor comments placed on them by the Architect shall be construed as being change orders.

PART 2 - PRODUCTS

2.1 MATERIALS

A. BAR REINFORCING STEEL

1. Unless otherwise specifically noted in Structural Notes, furnish deformed bars meeting requirements set forth in ASTM A615 minimum, Grade 60. Bars shall be unpainted, uncoated, and free from rust, dirt and loose scale.
2. Where reinforcing requires welded connections, and where specifically required by the drawings, furnish weldable reinforcing bars which meet the chemical requirements of ASTM A706 (Grade 60 ksi) with a minimum carbon equivalent of .55 percent.

B. WELDED STEEL WIRE FABRIC

1. Furnish welded wire fabric meeting requirements set forth in ASTM A185 and A82, Fy=65 ksi.

C. FIBROUS SECONDARY REINFORCEMENT

1. General:
   a. Use in all elevated concrete slabs, all topping slabs placed over plywood or metal decking, and all concrete mixes for interior and exterior slabs on grade and walls.
   b. Acceptable fibrous secondary reinforcement for slabs shall be filamentized nylon or polypropylene fiber which is inert to alkali and chemical attack; fiberglass fibers are not acceptable.
2. Concrete Fibers For All Interior and Exterior Slabs on Grade, Elevated Slabs, Topping Slabs Placed Over Metal Decking, and Walls, unless otherwise specified: Concrete fibers for all designated areas shall be 100% virgin polypropylene material. Fibers shall be ½" or ¾" and shall be Grace "Microfiber" by W.R. Grace, "Fibermesh 150" by Fibermesh Co., or equal. Fibers shall be used at a minimum dosage rate of 1-1/2 lbs. per cubic yard.

D. ACCESSORIES

1. General:
   a. Use wire bar type supports complying with CRSI recommendations, unless otherwise shown on Drawings. Do not use wood, brick, or other non-complying material.
   b. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   c. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized, plastic-protected legs, or stainless steel. In addition, portions of all accessories within ¾" of the concrete surface for painted or unpainted exposed concrete surfaces shall be stainless steel and bars shall be tied with stainless steel wire, whether for exterior or interior exposure.
2. Tie Wire:
   a. 16 gauge or heavier, double annealed wire.
3. Spacer Bars for Wall Reinforcing:
   a. No. 3 bars, "U" shaped. Stock items of equivalent function may be submitted for approval.
4. Mortar Blocks:

a. Furnish as required for use as spacers in placing reinforcement; shall be 2” square by 3” tall (maximum).
b. Mortar blocks shall be constructed of mortar mixed with the same proportions of sand and cement used in concrete and develop a minimum compressive strength of 4,000 psi at 28 days.
c. Mortar blocks shall have a tie wire embedded and the protruding ends to be tied to the reinforcing steel to hold the mortar blocks in place; mortar blocks with a grooved top may be used for supporting steel in slabs.
d. Do not use wood, brick, or other non-complying material.

5. Metal Chair Supports:
   a. In lieu of mortar blocks, furnish approved heavy-duty plastic-type chair supports, sized to support all slab steel to proper height and with cushioned pads to prevent vapor barrier membrane penetration.
6. Formsaver Splices:
   a. Formsaver splices shall develop 125% of the specified yield strength of the bar being spliced and shall be Dayton Superior D51A, nVent Lenton Formsaver, or equal.
7. Dowel Baskets:
   a. Dowel baskets shall be used to support smooth dowels at all dowel joints. Dowel baskets shall be of welded thick gauge steel wire construction and shall be hot dip galvanized or epoxy coated.
8. Plate Dowels:
   a. Plate dowels shall be Diamond Dowels by PNA Construction Technologies, Taper Dowels by SureBuilt Concrete Forms and Accessories, or equal.

2.2 FABRICATION

A. General:

1. Fabricate reinforcing bars to conform to the required shapes and dimensions, with fabrication tolerances complying with the CRSI Manual and ACI 318.
2. In case of fabricating errors, do not straighten or rebend reinforcement in a manner that will weaken or injure the material.
3. Reinforcement with any of the following defects will not be acceptable.
   a. Bar lengths, depths, and/or bends exceeding the specified fabrication tolerances;
   b. Bends or kinks not shown on the Drawings;
   c. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Hooks & Bends:

1. Minimum Bend Diameter: The diameter of bend measured on the inside of the bar for standard hooks, other than stirrup and tie hooks, not less than:

Bar Size	Minimum Diameter
#3 through #8	6 bar diameters

#9 through #11	8 bar diameters

2. Field bending of reinforcing bars, unless specifically noted on the Plans, will not be allowed. If bars are found to be field bent, especially brittle grade 60 bars, the Contractor will be responsible to provide corrective measures as directed by the Architect.

B. Cleaning Reinforcement:

1. Clean reinforcement, at time concrete is placed, free of mud, oil, or other materials that will reduce the bond. Conform to ACI 318 and IBC Chapter 19.

C. Placing & Fastening Reinforcement:

1. General:
   a. Conform to ACI 318.
   b. Prevent water from softening soil under reinforcing during steel placing.
   c. Conform to ACI 318 for placing, supports, tolerances, and draped fabric, unless noted otherwise on Drawings.
2. Placement:
   a. Place reinforcement as shown on Drawings.
   b. Accurately position in accordance with shop drawings; support and tie intersections in accordance with best practices and as necessary to secure reinforcement and prevent displacement by formwork, construction, or concrete placement operations.
   c. Locate and support reinforcing by metal chairs or mortar blocks as required; wood or foam supports are not acceptable.
   d. Support smooth bars at dowel joints by dowel baskets.
   e. Reinforcing bars may be relocated as necessary to avoid interference with other reinforcement, conduit, or other embedded items.
   f. If any reinforcing bar is moved a distance exceeding one bar diameter of the specified placing tolerance, the resulting rearrangement of the reinforcement shall be subject to acceptance by the Structural Engineer.
   g. Reinforcement to maintain minimum concrete coverage as shown.
3. Fastening:
   a. Securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement.
   b. Set wire so that ends are directed into the concrete.
   c. Wire tie stirrups and ties to main reinforcement.
4. Supports:
   a. General: Provide sufficient number of supports and of strength to carry the reinforcement. Do not place reinforcing bars more than 2 inches beyond last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
   b. On ground: Use concrete block.
   c. Over Formwork: In unexposed areas use concrete block or metal chairs. In exposed slabs and similar conditions use approved “invisible” metal chairs, hot-dip galvanized or approved plastic type.

D. SPACING OF BARS

1. Space reinforcing bars to comply with ACI 318 unless otherwise noted on Drawings. In conformance with placement requirements specified above, reinforcing bars may be relocated as necessary to avoid interference with other reinforcement, conduit, or other embedded items.

E. SPLICES IN REINFORCEMENT

1. CRSI standard by lapping ends, placing bars in contact, and tightly wire tying or by welding in an approved manner, except as noted otherwise. Do not splice bars except at locations shown on Drawings, except as otherwise specifically approved by Structural Engineer.
2. All welding to conform to “Recommended Practice for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete” of the American Welding Society (AWS D 12.1), performed in accordance with AWS D1.4.
3. All reinforcing bars requiring hooks: The minimum “Standard Hook” and leg extension, except as otherwise noted.
4. Splice in a manner developing at least 125% of the yielding strength of the bar.

F. SHRINKAGE & TEMPERATURE REINFORCEMENT

1. Conform to ACI 315 for reinforcement for shrinkage and temperature stresses normal to principal reinforcement where same is placed in one direction only.

G. CONCRETE PROTECTION FOR REINFORCEMENT

1. Conform to Structural Drawings and ACI 318.

H. STEEL DOWELS

1. Provide dowel bars where shown or required for connecting to in-place or subsequent work as shown.

I. PLACING WELDED WIRE FABRIC

1. Install in all concrete slabs on grade and concrete slabs on metal deck, except slabs where bar reinforcing is indicated; provide sizes specified herein or otherwise indicated, and with minimum coverages indicated for concrete protection.
2. Install welded wire fabric in as long of lengths as practical.
3. Lap adjoining pieces at least 12” or one full mesh spacing plus 2”, whichever is greater, and lace splices with 16 gauge wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
4. Do not carry through smooth-doweled expansion joints.
5. Provide chairs to support the welded wire fabric and reposition the welded wire fabric as required to maintain it at the proper position during concrete placement.

J. FIBROUS SECONDARY REINFORCEMENT

1. For all slabs on grade, elevated slabs, topping slabs, and walls as specified above, add fibrous reinforcing to concrete mix at the batch plant, at manufacturer’s recommended rate per cubic yard of standard weight and lightweight concrete mixes, and in strict accordance with fiber manufacturer’s printed instructions.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. WORK INCLUDED: Drawings and general provisions of the Contract Documents including General, Supplementary and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. RELATED WORK

1. Section 03 10 00: Concrete Formwork.
2. Section 03 20 00: Concrete Reinforcement.
3. Section 03 34 50: Concrete Finishing.
4. Section 07 92 00: Joint Sealants.

C. COORDINATION

1. Coordinate all installation under this Section with work of other trades.

D. Pre-Installation Meeting

1. Approximately two to four weeks prior to scheduled commencement of concrete installation and associated work, meet at project site with concrete subcontractor, associated finish, concrete polishing subcontractor, flooring, and coating Installer(s), Architect, Owner, Special Inspector, Structural Engineer, and other representatives directly concerned with performance of the work including (as applicable) test agencies and governing authorities.
2. Review foreseeable methods and procedures related to concrete work, including, but not necessarily limited to, the following:
   a. Inspect and discuss condition of substrates, penetrations and other preparatory work performed by other trades.
   b. Review concrete requirements (drawings, specifications, and other Contract Documents).
   c. Review required submittals, both completed and yet to be completed.
   d. Review and finalize construction schedule related to concrete work and verify availability of materials, Installer’s personnel, equipment and facilities needed to make progress and avoid delays.
   e. Review required inspection, certifying and material usage accounting procedures.
   f. Review weather and forecasted weather conditions as they may apply, and procedures for coping with unfavorable conditions, including requirements for temporary protection.
   g. Review special exposed concrete finishes and all associated items including special concrete mixes, materials, placing, curing, jointing, finishing, and protection requirements.
   h. Review methods of placing and finishing concrete slabs to achieve floor flatness and levelness requirements.
   i. Review Special Inspection requirements for concrete materials.

1.2 QUALITY ASSURANCE

A. GENERAL

1. Concrete shall conform to all minimum provisions of the latest edition of the (ASTM) American Society for Testing and Materials and the (ACI) American Concrete Institute noted

within this specification, except as modified by the Supplemental Requirements contained herein.

2. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
3. Preinstallation (or Preconstruction) Conference: Conduct conference at Project site to comply with requirements in Division 1 Section “Contractor Project Management and Coordination”.

B. STANDARD SPECIFICATIONS

1. Conform to ACI 301 “Specifications for Structural Concrete for Buildings.”
2. Conform to ACI 302 “Guide for Concrete Floor and Slab Construction”.
3. Conform to ACI 304 “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”.
4. Conform to ACI 306R “Recommended Practice for Cold Weather Concreting”; conform to ACI 305R “Recommended Practice for Hot Weather Concreting”.
5. Conform to ACI 308 “Standard Practice for Curing Concrete”.
6. Conform to ACI 318 “Building Code Requirements for Reinforced Concrete”.
7. Unless otherwise shown or specified, design, construct, erect, maintain, and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute Standard ACI 347, “Recommended Practice for Concrete Formwork”.

C. QUALITY CONTROL

1. Do not commence placement of concrete until mix designs have been reviewed and approved by the Architect and all governmental agencies having jurisdiction, and until copies are at the job site and the batch plant. Also, no concrete shall be placed until the Contractor has secured the Special Inspector’s and Architect's approval of the completed reinforcement placement.
2. See drawings and general provisions of the Contract Documents including General, Supplementary, and other Conditions and Division 1. Also see other requirements for testing and inspection as stated in Part 3 of this Section; conform to requirements, therefore, and furnish materials for tests. Give Inspector full cooperation.

D. NOTICE OF INTENTION TO PLACE CONCRETE

1. Notify Architect, Structural Engineer, and Special Inspector at least 48 hours prior to an intended pour.

1.3 SUBMITTALS

A. SUBMIT

1. Submit list of all items proposed to be provided under this Section together with manufacturer’s product data and installation instructions for all such proprietary materials.

B. Provide the following submittals in accordance with ACI-301:

1. Admixture certification. Chloride ion content must be included.
2. Aggregate certification.

3. Concrete mix design. Submit a mix design for each strength, and type of concrete. Clearly indicate where each mix design will be used.
4. Construction and control joints.
5. Materials and methods for curing (per Section 033450).
6. Laboratory tests on concrete.
7. Plans showing local test sections for flatness and levelness (per Section 033450).

1.4 JOB CONDITIONS

A. WINTER CONCRETING

1. Provide adequate equipment for heating materials and protecting concrete during freezing or near-freezing weather.
2. Keep all materials, reinforcement, forms, and ground in contact with concrete, free from frost; use no materials containing ice.

B. HOT WEATHER CONCRETING

1. Employ measures to reduce concrete temperature and water evaporation by proper attention to ingredients, production methods, handling, placing, protecting, and curing.

C. LOADING STRUCTURES

1. Protect all in-place structures from excessive loading. Shore and brace as necessary to prevent all damage.

D. FIELD REFERENCE MANUAL

1. A copy of ACI SP-15 “Field Reference Manual” which includes ACI 301 shall be kept in the Contractor’s Field Office at all times.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Provide in accordance with Section 031000 for all work of this Section.

2.2 CONCRETE MATERIALS

A. PORTLAND CEMENT

1. Provide a standard brand of Portland cement complying with ASTM C150, Type II, low alkali. Do not change the brand of cement during progress of the Work except as approved in writing by the Architect.

B. AGGREGATE

1. General
   a. Provide hardrock aggregate complying with ASTM C33, with additional attributes specified herein.
   b. For making grading tests of fine and coarse aggregate, use square mesh wire cloth complying with ASTM E11.

c. Aesthetic properties of aggregates which will be exposed at ground and polished slabs shall conform to the requirements of the Architect.

2. Fine aggregate
   a. Provide washed natural sand having strong, hard, durable particles, and containing not more than 2% by weight of deleterious matter such as clay lumps, mica, shale, or schist.
   b. Grade from coarse to fine within the following limits:

Sieve size:	Percentage by weight passing sieve: Minimum:	Maximum:
3/8"	100	---
No. 4	95	100
No. 8	80	100
No. 16	50	85
No. 30	25	60
No. 50	10	30
No. 100	2	10

3. Coarse aggregate
   a. Provide coarse aggregate consisting of clean, hard, fine grained, sound crushed rock or washed gravel, or a combination of both, containing not more than 5% by weight of flat, chip-like, thin, elongated, friable, or laminated pieces, nor more than 2% by weight of shale or cherty material. Any piece having a length in excess of five times the average thickness shall be considered flat or elongated.
   b. Use coarse aggregate of the largest practicable size for each condition of placement, subject to the following maximum size limitations: Do not exceed 3/4 of the clear distance between reinforcing bars 1/5 of the narrowest dimension between sides of forms, or 1/3 the depth of any slab section.
   c. Grade from course to fine within the following limits for the aggregate sizes shown:

Sieve size or size in inches:	Percentage by weight passing sieve: 1-1/2" (#4) aggregate: Min:	Max:	3/4" (#67) aggregate: Min:	Max:
2"	100	---	---	---
1-1/2"	90	100	---	---
1"	20	55	100	---
3/4"	0	15	90	100
1/2"	---	---	---	---
3/8"	0	5	20	55
No. 4	---	---	0	10
No. 8	---	---	0	5
No. 16	---	---	---	---

4. Combined gradation
   a. Mix designs shall make the best use of locally available materials to provide a uniform aggregate gradation. The Contractor shall submit mix designs that are suitable for the intended use, minimize shrinkage and have a proven history of superior performance.

C. WATER

1. Use only water which is clean and free from deleterious amounts of acid, alkali, salt, and organic materials.

2.3 ADMIXTURES

A. Use only standard brands of admixtures for concrete, approved by the Architect, meeting or exceeding the following requirements.

1. Air entraining admixtures shall conform to "Specifications for air-entraining admixtures for Concrete" ASTM C-260.
2. Water Reducing Admixture: "Eucon WR-75" by The Euclid Chemical Co., "Pozzolith 200N" by Master Builders, "Plastocrete 161" by Sika Corporation, WRDA-64 by W.R. Grace, or equal. The admixture shall conform to ASTM C-494, Type A and not contain more chloride ions than are present in municipal drinking water.
3. Water Reducing, Retarding Admixture: "Eucon Retarder-75" by The Euclid Chemical Co., "Pozzolith 100XR" by Master Builders, DARATARD-17 by W.R. Grace, "Plastocrete 161MR" by Sika Corporation, or equal. The admixture shall conform to ASTM C-494, Type D and not contain more chloride ions than are present in municipal drinking water.
4. Mid-Range Water Reducing Admixture: "Daracem-55" as manufactured by W.R. Grace, "Sikament HP" as manufactured by Sika Corporation, or equal. The admixture shall not contain calcium chloride, and shall conform to ASTM C-494, Type A.
5. High Range Water Reducing/Retarding Admixture (Superplasticizer): "ECON 537" by The Euclid Chemical Co., DARACEM 100 by W.R. Grace, "Sikament 320" by Sika Corporation, or equal. Admixture shall conform to ASTM C-494, Type G, and not contain more chloride ions than are present in municipal drinking water.
6. High Range Water Reducing Admixture (Superplasticizer): "Eucon 37" by The Euclid Chemical Co., WRDA-19 by W.R. Grace, "Sikament 86" by Sika Corporation, or equal. The admixture shall conform to ASTM C-494, Type F, and not contain more chloride ions than are present in municipal drinking water.
7. Non-Corrosive, Non-Chloride Accelerator: "Accelguard 80" by The Euclid Chemical Co., DARASET by W.R. Grace, "Plastocrete 161FL" by Sika Corporation, or equal. The admixture shall conform to ASTM C-494, Type C or E, and not contain more chloride ions than are present in municipal drinking water.
8. Concrete Corrosion Inhibitor: DCI Corrosion Inhibitor by W.R. Grace & Co., "Armatec 2000" by Sika Corporation or equal. The admixture shall conform to ASTM C-494 Type C. When this is specifically noted to be used, it shall be used at the dosage rate recommended by the manufacturer.
9. Shrinkage Reducing Admixture: Shall conform to ASTM C494 Type S, shall be used at the rate recommended by the manufacturer, and shall be “Eclipse Floor 200” by GCP Applied Technologies, “Eucon SRA Floor” by Euclid Chemical Company, or equal. Use at all architecturally exposed interior slabs on grade and at all concrete on metal deck.
10. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05% ions by weight of cement are not permitted.
11. Certification: Written conformance to the above mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Architect.

2.4 ACCESSORY MATERIALS

A. Expansion joint filler: Where shown to be used, provide preformed strips, non-extruding and resilient bituminous type, of thickness indicated, complying with ASTM D1751, ("Fibre Expansion Joint" by W.R. Meadows, Sika Joint Filler, or equal).

B. Curing and Sealing Compound: (Meeting ASTM C-309) The compound shall be a clear styrene acrylate type, 30% solids content minimum, and have test data from an independent testing laboratory indicating a maximum loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon. Compound shall be "Super Rez Seal" by The Euclid Chemical Co., "Vulkem 2101" by Mameco International, Inc., "Masterkure 30" by Master Builders, "Sealtight CS-309" by W.R. Meadows, or equal. Manufacturer's Certification required.

(Sodium Silicate Compounds are prohibited.) To be used where exterior concrete slabs are to be left exposed and where no special Architectural finish is specified.

C. Dissipating Resin Curing Compound: (Meeting ASTM C-309) The compound shall be a dissipating resin type compound, "Kurez DR" by The Euclid Chemical Co., "Vulkem 2100" by Mameco International, "Sealtight 3100" by W.R. Meadows, or equal. The film must chemically break down in a two-to-four week period. (To be used where a dissipating curing compound is required.) All curing compounds shall be certified to ensure that no conflict exists with any required floor covering adhesives.

D. Curing and Sealing Compound for Interior Slabs: The compound shall be VC-5 curing compound manufactured by SINAK, Euclid Ultrasil DC9, Ashford Formula, or equal. This compound shall be used at all interior Slab-on-Grade floors.

E. Bonding Materials: The compound shall be a polyvinyl acetate, rewettable type, "Euco Weld" by The Euclid Chemical Company, "Weld-crete" by The Larsen Company, or equal. Use only in areas not subject to moisture.

F. Bonding Admixture: The compound shall be a latex, non-wettable type, "SBR Latex" or "Flex-Con" by The Euclid Chemical Company, "Daraweld C" by W.R. Grace, or equal.

G. Structural Bonding Epoxy Adhesive: The compound shall meet ASTM C-881 and shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces, "Euco Epoxy #452 MV or #620" by The Euclid Chemical Company, "Sikadur Hi-Mod", "Sikadur 32 Hi-Mod LPL" by Sika Chemical Corporation, or equal.

H. Patching Mortar: "Verticoat" by The Euclid Chemical Co., "Sika Repair 223" by Sika Chemical Corporation, or equal. The compound shall be epoxy type, 100% solids, suitable for use on dry or damp surfaces.

I. Patching Compound: Free-flowing, polymer-modified cementitious repair mortar, "Euco Thin Top Supreme" by The Euclid Chemical Co., "SikaTop 121", "SikaTop 122" by Sika Corporation, or equal.

J. Interior Slab Epoxy Joint Filler: Shall be a multi component, 100% solids compound with a minimum shore D hardness of 50, "Euco Epoxy #700" by The Euclid Chemical Company, "Sikadur 51 NS/SL" by Sika Chemical Corporation, or equal. When and where this is specifically noted to be used, this shall be applied as late as possible after the concrete floor slab is poured, preferably at least 6 months, but not earlier than 2 months after the concrete floor slab is poured. Use only in locations specified.

K. Polished Slab Joint Filler: Joint filler at expansion joints in polished slabs shall be per Section 03 35 43 of these Specifications.

L. Non-shrink Grout: The grout shall conform to CRD C-621-83, "Corps of Engineers Specification for Non-shrink Grout". The grout shall be "Euco N-S" (non-metallic) by the Euclid Chemical Company, "Masterflow 713" (non-metallic) by Master Builders, "Sealtight 588 Grout" by W.R. Meadows, or equal.

M. Abrasive Aggregate for Non-slip Aggregate Finish: "Non-Slip" by The Euclid Chemical Company, "Alundum" by North Company, or equal.

N. Evaporation Retarder: The compound shall be "SikaFilm" by Sika Corporation, "Confilm" by Master Builders, “Eucobar” by Euclid Chemical Company, or equal.

O. Fiber Reinforcing: Fiber reinforcing for all designated areas shall be 100% virgin polypropylene material. Fibers shall be 1/2" or 3/4" in length: Grace "Microfiber" by W.R. Grace, "Fibermesh 150" by Fibermesh Co., Buckeye Ultra Fiber 500, or equal. Fibers shall be used at a minimum dosage rate of 1-1/2 lbs. per cubic yard.

P. V.O.C. Curing and Sealing Compounds: When curing and sealing compounds must meet V.O.C. regulations (or under such conditions where proper ventilation for safety is not possible), the curing and sealing compounds shall meet ASTM C-309 and shall be "Sealtight Vocomp 25" water-base acrylic cure and sealing compound by W.R. Meadows, Euclid Super Diamond Clear VOX, or equal. All curing and sealing compounds shall be coordinated with any floor coverings to insure that no conflict exists with the required adhesives.

Q. Chemical Floor Hardener: Liqui-hard by W.R. Meadows, Euco Diamond Hard by Euclid Chemical, or equal.

R. Waterstops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50° F to plus 175° F working temperature range, 4” wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; Greenstreak, J.P. Specialties Earth Shield, or equal. All waterstops shall comply with the Corps of Engineers CRD-C 572.

S. Self-Leveling Compound: Shall be Sika Level-325, Mapei Ultraplan M20 Plus, or equal.

2.5 EQUIPMENT FOR MIXING & PLACING

A. CONVEYING EQUIPMENT

1. Use crane bucket, wheelbarrow, pumps, or buggies to deliver concrete to placing location.
2. Chuting permitted only by methods to insure a practically continuous flow of concrete at delivery and to prevent material separation.
3. If pumping is employed, secure prior approval of equipment, procedures and mix design. No aluminum pipes or chutes will be permitted for pumping, chuting or tremie operations.

B. COMPACTION EQUIPMENT

1. Use internal mechanical vibrators with 7000 rpm minimum frequency.

2.6 CONCRETE MIXES

A. Provide a mix design prepared by the approved testing agency, based on strengths of the approved materials, and meeting the requirements stated on the Drawings.

B. Proportions for concrete mixes shall be in accordance with ACI 301. All mixes must be approved by the Architect prior to use on the job. No deviations from the approved mixes will be permitted without written prior approval of the Architect.

C. Where the concrete production facility can establish the uniformity of its production for concrete of similar strength and materials based on recent test data, the average strength used as a

basis for determining mix design proportions shall exceed the specified design strength by the requirements of ACI-318 or ACI-301.

D. When a concrete production facility does not have field test records for calculation of standard deviation, the required average strength shall be at least 1200 psi greater than the specified design strength.

E. Secure the Architect's approval of each mix design, including new mix designs required to be prepared should there occur a change in materials being used.

F. All concrete shall contain the specified water-reducing or water-reducing retarding admixture (superplasticizer). All concrete slabs, placed at air temperatures below 40° F shall contain the specified non-corrosive non-chloride accelerator. All concrete required to be air entrained shall contain an approved air-entraining admixture. All pumped concrete, concrete for industrial slabs, architectural concrete, concrete required to be watertight, and concrete with a water-cement ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer). All concrete slabs and flatwork, both interior and exterior, shall contain the specified fiber reinforcing. All concrete on metal deck and concrete at architecturally exposed interior slabs on grade shall contain shrinkage reducing admixture.

G. Prior to the jobsite addition of water-reducing admixture, concrete shall have a maximum slump of 3" for slabs and 4" for other members. This maximum slump may not be exceeded except by the job-site addition of the specified water-reducing admixture. The concrete shall arrive at the job site at the maximum slump indicated, be verified, then the water-reducing admixture added to increase the slump to the approved level. Concrete on metal deck containing water reducing admixture shall have a maximum slump of 6”. All other concrete containing water-reducing admixture shall have a maximum slump of 8" unless otherwise approved by the Architect. In those portions of the structure where member dimensions and/or congestion due to reinforcing steel prevent the proper placement and consolidation of the concrete at the maximum slump specified, water-reducing admixture shall be used by the Contractor in lieu of increasing the slump of the concrete by the addition of water.

I. Do not re-temper mix by adding water in the field.

J. Hardrock concrete

1. Achieve a unit weight of 130 pcf to 145 pcf and conform to the properties listed in the following table.

Location	Req’d. 28 day Compressive Strength	Maximum Water Cement Ratio	Air Content
Footings, grade beams, mat foundations, walls and all other concrete below grade	3000	0.50	3% Max. (entrapped)
Interior slabs on grade, and Interior walls	4000	0.45	3% Max. (entrapped)

Exterior concrete subjected to freezing and thawing and deicers including site walls and flatwork.	4500	0.45	5% - 7% (entrained)

K. Air Content at Interior Trowel-Finished Floors

1. The air content of interior trowel-finished floors shall not exceed 3%.

PART 3 - EXECUTION

3.1 PREPARATION

A. SURFACE CONDITIONS

1. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. CLEANING FORMS

1. Before placing concrete, clean spaces within forms of all refuse, debris and dirt. Provide cleaning holes for removal of foreign matter; after cleaning, replace forms at openings and brace to prevent form failure.

C. MIXING & PLACING

1. Conform to the requirements of ACI 301.
2. Clean free of all foreign matter and ice, all mixing and transporting equipment, subgrade and forms to receive concrete.
3. Clean reinforcement of deleterious coatings and ice.

D. EMBEDMENT FOR GENERAL WORK IN OTHER SECTIONS

1. Allow other trades time and facilities to install necessary embedded items such as nailers, hangers, inserts and sleeves; and other items as noted herein.

E. EMBEDMENT FOR MECHANICAL & ELECTRICAL WORK

1. Pipes and conduits may penetrate slabs within the limitations shown in the structural Drawings but will not be allowed to run in slabs on grade or elevated slabs without written permission from the Architect.
2. Place sleeves and core forms as required for mechanical and electrical work, sizes and locations as shown on the Drawings or as directed by relevant trades.

3.2 INSTALLATION OF FORMWORK

A. In accordance with Section 03 10 00.

3.3 CONCRETE MIXING

A. Concrete for minor work, when approved by the Architect, may be mixed at the site in a power mixer when the mixer has a capacity not less than one full sack batch.

B. Unless otherwise approved by the Architect, use ready mixed concrete complying with ASTM C94.

1. Mixing
   a. Mix each batch of concrete not less than 15 minutes, five minutes of which shall be at the site.
   b. Rotate the drum at the rate specified by the manufacturer of the mixer as "mixing speed."
   c. Whenever there is a delay in unloading, rotate the drum slowly at intervals to prevent incipient set of concrete.
2. Addition of water:
   a. Normally, do not deliver concrete with total permissible amount of water incorporated therein.
   b. After water is added, at least five minutes of mixing time shall be immediately prior to discharge.
   c. Concrete will be rejected if not placed in final position within 1-1/2 hours after water is first added to the batch.
3. Concrete at time of placing shall be in such condition that it can be placed properly.
4. Discharge all wash water from the mixing drum before the truck reloads at the batching plant.
5. Mixing equipment shall not be charged beyond its rated capacity.

C. Concrete consistency

1. Use the amount of water established by the approved mix design.
   a. Do not exceed the maximum quantity specified for the grade of concrete.
   b. Use the minimum amount of water necessary to produce concrete of the workability required by the Architect.
   c. Do not supplement the predetermined amount of water with additional water for any reason.
2. Measure concrete consistency by ASTM C143 method.
3. Prior to the on-site addition of water-reducing admixture, provide maximum slumps of concrete as follows:
   a. Footings and slabs on soil: 3", (+1", -1").
   b. Other concrete: 4".

D. Cement grout and dry-pack grout

1. Mix at the site, in composition of one volume of portland cement to 2-1/2 volumes of fine aggregate.
2. Mix the materials dry; then add sufficient water to make the mixture flow under its own weight.
3. When grout is used as dry-pack concrete, add sufficient water to make a stiff mixture which can be molded into a sphere.

E. Miscellaneous provisions

1. Provide strengths of concrete as shown on the Drawings and the table herein.
2. Provide concrete dense and free from honeycomb and other defects.
3. Place and finish members to conform to the shapes and dimensions indicated, with all surfaces true to line, plumb, and level.

3.4 INSERTS, ANCHORS, AND EMBEDDED ITEMS

A. Concrete fasteners

1. Where hanger rods, bolts, wire, or similar items are used to suspend construction items, place in the concrete as required and/or indicated.

B. Reglets, Reveals, and Rebates

1. Form reglets, reveals and rebates as required to receive frames, flashing, and other equipment, and as shown on the Drawings.
2. Verify the dimensions and positions of required reglets, reveals, and rebates with the Architect and with trades whose work is related to or contingent upon such dimensions and positions.

C. Embedded Piping, and Rough Hardware

1. Coordinate the various trades who are required to fasten work to the structure, or are required to insert therein any sleeve, box, bolt, anchor, insert, or other rough hardware.
2. Provide every facility for setting all required items accurately in the forms.
3. Be responsible for changes in position of such items after they have been set.
4. Provide in the forms for all sleeves, boxes, bolts, anchors, inserts, strap anchors, for frames, and other rough hardware required for the Work, and which are shown or required to be embedded in the concrete.
5. Conduits and sleeves
   a. Do not place pipes or conduits in slabs on grade or elevated slabs.
   b. Conduits or pipes shall run below elevated slabs or they shall be located in trenches below slabs on grade.

3.5 CONVEYING AND PLACING CONCRETE

A. Before placing concrete, thoroughly clean forms, wash out with water, and make tight.

B. Time of placing

1. Do not place concrete until reinforcement, conduits, outlet boxes, anchors, sleeves, hangers, bolts, and other embedded materials are securely and properly fastened in their correct positions.
2. Secure the Architect's approval of reinforcement before commencing placement of concrete.

C. Preparation

1. Before new concrete is deposited upon or against concrete that has taken its initial set or has hardened, remove all incrustations from forms and reinforcement.
2. Remove all laitance, oil, and loose particles from concrete and concrete surfaces, and thoroughly clean the forms with water under stiff pressure.
3. Remove all laitance after concrete has hardened partially (not less than two hours nor more than four hours after placing) by brushing with stiff bristles, or by directing a stream of water from a 1/4" nozzle, or by other methods approved by the Architect, to expose the clean top surface of the coarse aggregate.

4. Where cleaning is not satisfactory to the Architect, sandblast the surface and then wash again.

D. Method of placing

1. Place concrete only under the degree of inspection described elsewhere in these Specifications, and as required by governmental agencies having jurisdiction.
2. Do not place concrete outside of regular working hours unless required inspection authorities have been notified properly and are present.
3. Spouts, pipes, troughs, belts, chain buckets, and other equipment may be used in conveying concrete, but the manner and method used shall be only as approved by the Architect.
4. Do not permit concrete to free drop more than 4'-0".
5. Deposit concrete direct into conveyances, and direct from conveyances to final points of repose, except where troughs, buckets, or the like are used, in which case dump concrete into hoppers and then into the conveyances.
6. Where tremies are used, or where the free drop is 4'-0" or more, and through reinforcement, use a dumping box or board, moving the concrete from there by shovels or hoes.
7. Deposit concrete so that the surface is kept level throughout, a minimum being permitted to flow from one position to another, and place as rapidly as practicable after mixing.
8. Do not use in this Work any concrete not placed within 30 minutes after leaving the mixer.

E. Tamping and conveying

1. Thoroughly work concrete around reinforcement and embedded fixtures, and into corners of forms, during placing operations.
2. Completely compact and vibrate all concrete including floor slabs with mechanical vibrators and by tapping forms until the concrete is thoroughly compact and without voids. Determine the number of tampers and vibrators needed by the amount and method of placing concrete.
3. Exercise care to tamp and vibrate concrete vigorously and thoroughly to obtain maximum density.
4. Use manual tampers as well as mechanical vibrators.
5. Exercise care to direct the quick handling of vibrators from one position to another.
6. Do not over-vibrate concrete.
7. Do not move concrete by use of vibrator.
8. Have at least one spare vibrator on site during all concrete pours.

F. Stoppages

1. Stop concrete placing only when and where approved by the Architect.
2. Maintain flow surfaces of freshly placed concrete as level whenever a pour is stopped, providing tight dams to accomplish this.
3. Make horizontal construction joints only where shown on the Drawings or specifically approved by the Architect.
4. Provide keys and dowels at construction joints where indicated on the Drawings, and where concrete placement is interrupted.

3.6 STEPS, SLABS, WALK, AND PAVING ON EARTH

A. Preparation for slabs on earth

1. Prepare the subgrade and base as specified in other Sections.
2. Dampen the subgrade for exterior slabs and paving if necessary prior to placing concrete.

B. Placing and finishing

1. Mechanically vibrate and then tamp the freshly placed concrete until at least 3/8" of mortar is brought to the surface.
2. Screed until depressions and irregularities are worked out and the surfaces are true to specified elevations, flatness, and levelness.
3. Remove excess water and debris worked to the surface in compaction and screeding.
4. Remove laitance as described previously.
5. When concrete has hardened sufficiently, float to a compact and smooth surface.

C. In Slabs-On-Grade Provide

1. Contraction (control) joints in interior work.
   a. By use of tooled control joints or at Contractor's option by sawcutting to 1/4 slab depth.
   b. Where not otherwise shown on Drawings, provide control joints at column centerlines and/or at the following maximum spacing:
      4" slab max. spacing = 10 ft. each way.
      5" slab max. spacing = 10 ft. each way.
      6" slab max. spacing = 12 ft. each way.
      7" slab max. spacing = 14 ft. each way.
      8" slab max. spacing = 14 ft. each way.
   c. Provide close coordination with the Architectural joint layout, pattern and spacing for all exposed to view floor slabs. This layout shall be verified prior to pouring concrete.
2. Joints in Exterior Work
   a. Provide contraction joints in exterior work where shown by means of 1" deep tooled joints with edges rounded and tool marks removed. If the layout of the contraction joints is not shown on the plans, then the Contractor shall submit a proposed layout to the Architect for approval with joints at a maximum of 5’-0” o.c.
3. At all construction joints of slabs on grade (doweled joints), discontinue slab reinforcement, and provide smooth, greased dowels supported on dowel baskets per the provisions of Section 032000 of these Specifications.
4. Where shown to be used, provide isolation joints between slabs and vertical surfaces. Form with 15# felt paper for interior work and expansion joint filler for exterior work.
5. Except at polished slabs, seal all expansion and contraction joints with the here-in specified joint sealing compound.
6. Seal expansion joints at polished slabs with the joint sealing compound specified in Section 03 35 43 of these Specifications.
7. Provide the finish surfaces shown on the Drawings or otherwise directed by the Architect, in accordance with pertinent provisions of Section 033450 of these Specifications.

D. Curing
1. Cure and protect concrete in accordance with pertinent provisions of Section 033450 of these Specifications, and ACI 302.

3.7 SODA AND ACID WASH

A. At concrete surfaces to receive plaster, paint, or other finish, and which have been formed by oil-coated forms, scrub with a solution of 1-1/2 lbs caustic soda to one gal. of water.

B. On surfaces where smooth wood or waste molds have been used, scrub with a solution of 20% muriatic acid or hydro-chloric acid.

C. After the surfaces have been scrubbed, wash with clean water as soon as possible.

3.8 DEFECTIVE CONCRETE

A. The following concrete will be deemed to be defective, and shall be removed promptly from the job site.

1. Concrete which is not formed as indicated, is not true to intended alignment, is not plumb or level where so intended, is not true to intended grades and levels.
2. Has voids or honeycombs that have been cut, resurfaced, or filled, unless with the approval of the Architect.
3. Has sawdust, shavings, wood, or embedded debris.
4. Has cracking which is more than minor hairline cracks, and which are unacceptable to the Architect.
5. Has curled slab edges which are functionally or architecturally unacceptable to the Architect.
6. Does not meet the specified floor flatness and levelness listed in Specification Section 033450.
7. Or does not conform fully to the provisions of the Contract Documents.

B. Repairs and Replacements

1. When required by the Architect, defective concrete shall be cut out to the extent directed by, and replaced using material and methods as approved by, the Architect.
2. Where defective concrete is found after removal of the forms, cut out the defective concrete, if necessary, and make the surfaces match adjacent surfaces.
3. Repair of Surface Defects. All voids, damaged places, fins, projections, honeycomb areas, and tierod holes shall be removed down to sound concrete and shall be repaired immediately after form removal and after a concrete curing compound is applied. The specified bonding agent shall be used for all patching and the specified epoxy adhesive and/or epoxy mortar shall be used for all structural repairs. All patching and repairs shall have prior approval of the Architect as to method and procedure. Any concrete which has not been formed as shown on the contract drawings, is out of alignment or level or indicated a defective surface or unsoundness of any nature shall be removed and replaced to the limits required by the Architect unless he grants permission to patch or otherwise correct the defective work. Permission to patch or attempt the correction shall not be construed to be a waive of the Architect's right to require complete removal of defective work.
4. Work uneven surfaces and angles of concrete to a surface matching adjacent concrete surfaces.
5. The cost of removing, replacing, and repairing defective concrete shall be at the Contractor’s expense.

3.9 GROUTING AND CEMENT POINTING

A. All column base plates, equipment bases, and other locations noted on the structural drawings shall be grouted with the specified non-shrink grout. All exposed grout shall be the specified non-metallic type.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Walls and curbs

1. Construct header walls and curbs as shown on the Drawings.
2. Trowel exposed concrete surfaces smooth.

B. Leave openings in the floor slabs and future foundations for machines and equipment, where so indicated on the Drawings, and in dimensions and arrangements required for the approved machines and equipment.

3.11 INSPECTIONS & TESTING

A. The required testing services of Section 16.3 and 16.4 of ACI-301 shall be performed by an independent testing laboratory approved by the Architect and paid for by the Owner. The testing services required in Section 16.5 shall be performed by the same testing laboratory and paid for by the General Contractor.

B. The testing laboratory representative shall be present during the placement of all concrete unless this requirement is waived by the Architect. The testing laboratory shall conduct the tests specified in 16.3 and in addition shall inspect the reinforcing steel placement (including grade of steel) prior to the beginning of placement. The Contractor shall provide ample notice to the testing laboratory and shall make available to the testing laboratory, shop drawings of the reinforcing steel placement bearing the shop drawing review stamp of the Architect.

C. When requested the testing agency shall provide evidence of recent inspection (within the last three years) of its facilities by the Cement and Concrete Reference Laboratory of the National Bureau of Standards. Evidence shall be presented to indicate that deficiencies mentioned in the report of that inspection have been corrected.

D. Standard slump and cylinder samples (3) must be taken after addition of water. The method of measuring water and the person(s) authorized to add water and make samples must be mutually responsible for cost of additional sampling and testing costs related to discharging concrete in conflict with Contract Documents. All concrete requiring a slump change of more than 2", except when the water-reducing admixture is being used, will be rejected.

E. Compression test specimen: ASTM C 31, one set of 3 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required. Test one cylinder at seven days, one at 28 days, and hold the third cylinder until needed.

F. Slump and compressive strength tests: ASTM C 39 one set for each 50 cu. yd. or fraction thereof, of each class of concrete placed in any one day or for each 5000 sq. ft. of surface area placed: one specimen tested at 7 days, one specimen tested at 28 days and one specimen retained in reserve at the laboratory for later testing if required.

G. Determine air content of normal-weight concrete for each strength test. In addition, for all exterior flat-work concrete, determine air content per ASTM C 231 for each 20 cu. yd. placed.

H. When concrete fails to meet the acceptance criteria specified in ACI-301, the Architect may order further testing of concrete in place in accordance with ACI 301. When such tests are ordered, cost of testing shall be paid by the Contractor.

I. The Contractor shall bear all cost of correcting rejected work, including the cost of the Architect's additional services thereby made necessary.

END OF SECTION 033000

SECTION 03 34 50 - CONCRETE FINISHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Drawings and general provisions of the Contract Documents including General, Supplementary and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. Related work:

1. Section 03 30 00: Cast-in-place concrete.
2. Section 07 92 00: Joint Sealants

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Except as may be modified herein or otherwise directed by the Architect, comply with ACI 301, "Specifications for Structural Concrete for Buildings."

C. Preinstallation (or Preconstruction) Conference: Conduct conference at Project site to comply with requirements in Division 1 Section “Project Management and Coordination”.
1. Approximately two to four weeks prior to scheduled commencement of concrete installation and associated work, meet at project site with concrete subcontractor, associated finish, flooring, and coating Installer(s), Architect, Owner, Special Inspector, Structural Engineer, and other representatives directly concerned with performance of the work including (as applicable) test agencies and governing authorities.
2. Review foreseeable methods and procedures related to concrete work, including, but not necessarily limited to, the following:
   a. Inspect and discuss condition of substrates, penetrations and other preparatory work performed by other trades.
   b. Review concrete requirements (drawings, specifications, and other Contract Documents).
   c. Review required submittals, both completed and yet to be completed.
   d. Review and finalize construction schedule related to concrete work and verify availability of materials, Installer’s personnel, equipment and facilities needed to make progress and avoid delays.
   e. Review required inspection, certifying and material usage accounting procedures.
   f. Review weather and forecasted weather conditions as they may apply, and procedures for coping with unfavorable conditions, including requirements for temporary protection.
   g. Review special exposed concrete finishes and all associated items including special concrete mixes, materials, placing, curing, jointing, finishing, and protection requirements.
   h. Review Special Inspection requirements for concrete materials.

D. STANDARD SPECIFICATIONS

1. Refer to Section 03 30 00 for same and conform thereto as they apply to concrete curing and finishing work of this Section.

E. DEFECTIVE WORK

1. Contractor shall remove and replace at his own expense all defective work as adjudged by the Architect.

1.3 SUBMITTALS

A. SUBMIT:

1. Submit manufacturer's product data and installation instructions for proprietary materials including curing agents, sealers, hardeners, and the like.

1.4 JOB CONDITIONS

A. Refer to Section 03 30 00 for same and conform thereto as they apply to concrete curing and finishing work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete materials: Comply with pertinent provisions of Section 03 30 00, except as may be modified herein.

B. Surface Retardant for Exposed Aggregate Finish: Furnish Sika “Rugasol C”, Anti-Hydro Waterproofing Co. or Master Builders or Protex Ind., Inc., or equal, liquid chemical surface retardant.

C. Curing Compound for Curing Exterior Slabs and Walls:

1. Furnish liquid membrane-forming curing compound conforming to ASTM C309, Type I clear. Compound shall be a clear styrene acrylate type, 30% solids content minimum, and have test data from an independent testing laboratory indicating a maximum loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon.
2. Compound shall be “Super Rez Seal” by The Euclid Chemical Co., “Vulkem 2101” by Mameco International, Inc., “Masterkure 30” by Master Builders, “Sealtight CS-309” by W.R. Meadows, or equal.
3. Manufacturer’s Certification required. (Sodium Silicate Compounds are prohibited.)

D. Curing Compounds, Protection Paper, and Curing Blankets for Curing Interior Slabs

1. For Recessed Slab Surfaces to Receive Tile Setting Bed: Furnish 6 mil clear visqueen or reinforced waterproof kraft paper conforming to ASTM C171, Type I; liquid membrane-forming curing compound shall not be used for curing interior recessed slabs.
2. For Slabs to Receive Floor Coverings, Interior Slabs to be Sealed, and Interior Slabs to be Left Exposed: Curing compound shall be fully compatible with all flooring adhesives

and sealers to be used on the Project and guaranteed by the manufacturer, in writing, not to impair bonding sealer or adhesive, as applies. Furnish VC5 curing compound manufactured by SINAK, Euclid Ultrasil DC9, Ashford Formula, or equal. Use on all interior slabs-on-grade and all interior elevated concrete slabs on metal floor deck.

E. Sealer

1. For interior slabs to receive sealed finish furnish acrylic polymer, water-based sealer conforming to ASTM C309, Type I, Class B clear, non-yellowing; W. R. Meadows “VOCOMP-25”, Euclid Super Diamond Clear VOX, or equal. All curing and sealing compounds shall be coordinated with any floor coverings to ensure that no conflict exists with the required adhesives.

F. Structural Concrete Repair Mortar

1. Furnish Mapei Planitop XS with Planicrete AC additive, SikaRepair SHB with Sika Latex R, or equal.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISHING OF FORMED SURFACES AND REPAIR OF SURFACE DEFECTS

A. General:

1. After removal of forms, give the concrete surfaces one or more of the finishes specified below where so indicated on the Drawings, or directed by the Architect.
2. Immediately after form removal, patch all tie holes and repairable defective areas.
3. Revise the finishes as needed to secure the approval of the Architect.

B. Formed Surfaces to be Concealed in the Finished Work:

1. Leave surfaces with the texture imparted by forms, except patch tie holes and defects.
2. Remove fins exceeding 1/4" in height.

C. Formed Surfaces to be Left Exposes in the Finished Work: All exposed concrete not otherwise specified shall be treated as follows:

1. Fin Removal:
   a. Completely remove all surface fins by hand or power grinding with carborundum stone or power grinder to approved smoothness on surfaces to be left exposed.
2. Voids, Gravel Pockets and Similar:
   a. Cut out defective areas 1” deep; vertical edges.
   b. Wet cavities and adjacent area.
   c. Cement mortar to match adjacent areas, use as little water as possible.
   d. Retemper after 1 to 2 hours for shrinkage, as required.

e. Thoroughly fill voids and finish off, match adjacent surface in exposed work.
f. Finish with “Sacked Finish” as specified below.
g. Keep patched and finished areas damp for 7 days.

3. Tie Holes:
   a. Clean and thoroughly dampen; fill solid with patching mortar as specified above for voids and pockets.

D. Sacked Finish

1. General:
   a. Provide sacked finish as specified below on all exposed surfaces of building walls and other dominant exposed surfaces.
2. Sacked Finish:
   a. Pre-dampen concrete while still green and apply matching color slurry of patching material specified above for minor defective areas and apply with burlap or sponge float.
   b. Remove any surplus, then rub with clean burlap; cure in approved manner.
   c. All sacked finish surfaces shall be smooth and uniform in appearance, pinhole free, with all imperfections completely concealed.

E. Wall & Curb Tops, Horizontal Offsets, Other Unformed Surfaces

1. In general, strike smooth after placing concrete, float to continued uniform surface and to texture reasonably consistent with adjacent formed surfaces, as approved.

3.3 FINISHING SLABS

A. Tolerances

1. The Contractor shall use proper equipment, techniques, personnel, quality control procedures, and other means and methods as required to achieve the slab tolerances noted herein. Where required to achieve these tolerances, special placement equipment such as laser screeds shall be used.
2. The cross-sectional thickness of slabs on grade shall be within +3/8” and -1/4” of the thickness designated on the plans. The cross-sectional thickness of elevated slabs shall be the thickness designated on plans as minimum.
3. The final elevation of slabs on grade shall be within ±1/2” of the elevation designated on plans. At elevated slabs the Contractor is required to compensate for steel deflections and the final elevation of elevated slabs shall be within +0” and -1/2” of the elevation designated on plans.
4. Measurements:
   a. All floors shall be measured in accordance with ACI 117’s straightedge method for flatness. One sample shall be taken from each 100 ft^2 and samples must be taken parallel, perpendicular, or at a 45º angle to the longest construction joint of the area.
   c. All floor tolerance measurements shall be made within 24 hours after slab installation. Results of all floor profile tests shall be provided to the Architect within 72 hours after each slab placement.
5. For the floor flatness straightedge method, the maximum gap between a 10 ft straightedge and the floor surface shall not exceed:
   a. Slabs on grade:
      90% of the samples shall not exceed: 1/4”
      100% of the samples shall not exceed: 3/8”
      Variation in 12” shall not exceed: 1/16”

7. Where slab edges curl to an extent that they are either functionally or architecturally unacceptable, the Contractor shall be responsible to provide corrective measures to the approval of the Architect. This requirement shall remain in force throughout the warranty period.
8. Non-conforming work shall require corrective actions where directed by the Architect. Corrective actions shall be as directed by the Architect, to the extents determined by the Architect and may include, but shall not be limited to: the application of a different flooring or finish, the application of a floor leveling/patching compound in low spots, the grinding down of high spots, or the complete removal and replacement of nonconforming concrete. To maintain consistency of the finish appearance, corrective actions may be required beyond the immediate area of non-conforming work to include as much as the entirety of all exposed slabs on a project.
9. Corrective measures for non-conforming work shall be at the Contractor's cost.

B. Slab Finishes

1. Unless otherwise shown, scheduled or specified hereinafter, use the following finishes, as applicable:
   a. Furnish smooth troweled finish for all floors to receive resilient floor coverings and carpeting.
   b. Furnish smooth troweled finish for all interior floors to remain as walking surfaces.
   c. Furnish smooth troweled finish for all exterior equipment pads, dumpster pads, and the like.
   d. Furnish broomed float finish for interior recessed slabs to receive ceramic floor tile finishes and associated setting beds.
   e. Furnish exposed aggregate finish of portions of exterior walks as indicated on Architectural and Landscape Drawings.
   f. Furnish broomed trowel finish for all exterior walks, ramps, stairs and miscellaneous slab surfaces not otherwise specified to receive smooth trowel or exposed aggregate finishes.
   g. Furnish "tactile" diamond pattern finish, in addition to broom finish, at handicap ramp cur-cut slab areas indicated to receive "tactile warning surface".
   h. Furnish "non-slip" finish for cast-in-place curbs and associated gutters, as applicable, integral with sidewalks.
2. Before finishing work begins, place, strike off, consolidate and level and/or slope, as applicable, concrete to condition ready for finishing.
3. Consolidate placed concrete preferably with power driven floats of impact type except for thin joist slabs; use wood or cork-faced hand floats for surfaces inaccessible to power floats.
4. At slab-on-grade floor areas scheduled to receive tile flooring and associated mortar setting bed, recess slabs 2"; slope recessed slabs in these areas to allow for uniform thickness of tile setting bed material.
5. Replace slabs with excessive shrinkage cracks and those not properly sloped and finished to floor flatness and leveling tolerances specified above, as approved, without additional cost to Owner.

C. Float Finish:

1. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further until ready for floating.
2. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
3. During or after the first floating, check the planeness of the surface with a ten foot straightedge applied at not less than two different angles.
4. Cut down high spots and fill low spots.

5. Refloat the slab immediately to a uniform sandy texture.

D. Broomed Float Finish:

1. Provide a floated finish as described above. After floating, draw a broom across surface to a light scored texture finish, as approved.

E. Troweled Finish:

1. Provide a floated finish as described above, followed by a power troweling and then a hand troweling.
   a. Produce an initial surface which is relatively free from defects, but which still may show some trowel marks.
   b. Provide hand troweling when a ringing sound is produced as the trowel is moved over the surface.
   c. Thoroughly consolidate the surface by hand troweling.
2. Provide a finished surface essentially free from trowel marks, uniform in texture and appearance.
3. On surfaces intended to support floor coverings, use grinding or other means as necessary and remove all defects of such magnitude as would show through the floor covering.

F. Broomed Trowel Finish:

1. Power float to trueness within the specified tolerance, and provide one-pass steel troweling. After troweling, draw a broom across surface to a light transverse scored texture, as approved.

G. Exposed Aggregate Finish:

1. Allow concrete to receive exposed aggregate finish to dry free of surface water before placing finish. Do not use accelerators or retarders in concrete to receive surface retardant treatment.
2. Apply surface retardant by roller or spray, coverage 80 to 100 square feet each gallon of retardant or as otherwise recommended by retardant manufacturer's label instructions.
3. Removing Retardant Treated Mortar:
   a. Within 12 to 24 hours, hose surface with water and scrub with stiff broom or brush, to approximately 1/8" depth; actual depth as determined by approved sample panel.
   b. Continue brushing until selected aggregate is exposed, but not dislodged, and top surface of stainless steel control joints is exposed.
   c. Clean off excess and removed material, protect and cure as hereinafter specified.

H. "Tactile" Finish:

1. After floating and applying broom finish, imprint surface of handicap curb cuts with a diamond pattern texture using an expanded metal grate imprinting tool, as approved.

I. Non-Slip Finish:

1. After troweling, obtain finish by dragging a strip of clean, wet burlap across the slab and curb surfaces to produce a fine, granular, or sandy textured surface without disfiguring marks.
2. Round edges and joints in curbs with an edger having a radius of ¼".

J. Exterior Control Joint & Slab Edge Treatment:

1. Steel tool all control joints, all exposed perimeter edges, and edges of expansion joints, prior to filling with sealant, to a smooth bullnose form, using an edger having a radius of ¼", as approved.
2. Form control joints in uniform straight lines, spaced no greater than 5 feet apart. Coordinate exact locations and alignment with Architect.

3.4 CURING AND PROTECTION

A. The Contractor shall use all necessary precautions to keep cracking of all concrete work to an absolute minimum. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures, and mechanical injury.

1. Maintain curing procedures used for seven (7) days at minimum temperature of 50° F; if mean daily temperature drops below 40° F during this period, extend curing period an equal number of days or provide temporary heat or additional protection to maintain specified minimum temperature of air in contact with concrete.

B. Temperature, wind, and humidity;

1. When concrete slab placements are subjected to high temperatures, wind and/or low humidity the Architect may require the use of the specified evaporation retarder to minimize plastic cracking. The compound may be required to be applied one or more times during the finishing operation. The initial application is usually made after the strike-off operation.
2. Cold weather:
   a. When the mean daily temperature outdoors is less than 40° F, maintain the temperature of the concrete between 50° F and 70° F for the required curing period.
   b. When necessary, provide a proper and adequate heating system capable of maintaining the required heat without injury due to concentration of heat.
   c. Do not use combustion heaters during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
   d. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   e. Only the specified non-corrosive non-chloride accelerator shall be used. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.
3. Hot weather:
   a. When necessary, provide wind breaks, fog spraying, shading, sprinkling, ponding, or wet covering with a light colored material, applying as quickly as concrete hardening and finishing operations will allow.
4. Rate of temperature change:
   a. Keep the temperature of the air immediately adjacent to the concrete during and immediately following the curing period as uniform as possible and not exceeding a change of 5° F in any one hour period, or 50° F in any 24 hour period.

C. Curing Walls & Formed Surfaces:

1. Where forms are exposed to the sun, minimize moisture loss by keeping the forms wet until they can be removed safely.

2. In hot weather, immediately after forms have been removed, cure by spraying walls with liquid membrane-forming compound specified above for exterior walls, applied at not less than the manufacturer's specified and recommended rate.
3. In freezing weather, protect in accordance with ACI 301.

D. Curing Exterior Slabs:

1. Spray slabs with liquid membrane-forming compound specified above for exterior slabs, applied at not less than the manufacturer's specified and recommended rate.

E. Curing Interior Slabs:

1. For Recessed Slab Surfaces: Install appropriate sheeting as specified above, installed over slabs immediately upon completion of surface finish work as work proceeds. Lap 3 inches and tape or otherwise seal edges and hold down by adequate means to prevent dislodgment. Maintain covering for a minimum of seven (7) days. Repair any damage to membrane which allows escape of slab moisture. Maintain membrane upkeep until full removal.
2. For Slabs to Receive Resilient and Carpet Floor Coverings:
   a. Spray new slab surfaces with the curing compound specified above, applied at not less than the manufacturer's specified and recommended rate and in accordance with manufacturer's written instructions.
   b. In addition, all floor slabs shall be covered with blankets for a minimum of 72 hours after pouring.
3. For Slabs to be Left Exposed and Sealed:
   a. Spray new slab surfaces with the curing compound specified above, applied at not less than the manufacturer's specified and recommended rate and in accordance with manufacturer's written instructions.
   b. In addition, all floor slabs shall be covered with blankets for a minimum of 72 hours after pouring.
   c. After curing compound has fully dried per manufacturer's recommendations, Contractor shall cover such slab surfaces with protective sheeting as necessary to avoid damage due to subsequent construction work and prior to final finishing of such floor surfaces as specified below.
4. For Slabs to be Ground and Polished:
   a. Spray new slab surfaces with the curing compound specified above, applied at not less than the manufacturer's specified and recommended rate and in accordance with manufacturer's written instructions.
   b. In addition, all floor slabs shall be covered with blankets for a minimum of 72 hours after pouring.

F. Protection from mechanical injury and staining:

1. During the curing period, protect all concrete during period from damaging mechanical disturbances, more especially load stresses, heavy shock, and excessive vibration.
2. Protect finished concrete surfaces from damage from construction equipment, materials and methods, from application of curing procedures, and from rain and running water.
3. Do not load self-supporting structures in such a way as to overstress the concrete.
4. Take care to prevent staining to concrete surfaces which will receive a polished finish and other surfaces to be exposed in the final construction.
5. After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

3.5 APPLIED FINISHES

A. Sealed Finish: Where sealed finish is scheduled

1. Apply sealer strictly in accordance with the sealer manufacturer's written application instructions and recommendations, for a uniform, low gloss sheen finish.

END OF SECTION 03 34 50

SECTION 05 10 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Requirements

1. Drawings and general provisions of the Contract Documents including General, Special and other Conditions and Division 1, “General Requirements” Section, apply to the work specified in this Section.

B. General Description of Work

1. In general, work under this Section includes providing structural steel as shown on the Drawings, specified herein, and needed for a complete and proper installation in each case.

C. Related Work in Other Sections

1. Section 05 50 00: Miscellaneous Metal

1.2 QUALITY ASSURANCE

A. STANDARD SPECIFICATIONS & CODE OF PRACTICE

1. Standard Specifications:
   a. "Steel Construction Manual", current edition, as issued by the American Institute of Steel Construction (AISC); hereinafter called “Standard No. 1”.
   b. Unless otherwise noted, furnish material conforming to the Standard No. 1 of types shown on the Structural Drawings.
2. Code of Practice:
   a. AISC "Code of Standard Practice for Steel Buildings and Bridges", current edition, hereinafter called "Standard No. 2”.
   b. Unless otherwise noted, wherever the term "Owner" is used in Standard No. 2, it shall mean "General Contractor or other trades, all as specified in other Sections of these Specifications".

B. STANDARD SPECIFICATIONS FOR SURFACE PREPARATION FOR PRIMING

1. Steel Structures Painting Council (SSPC) "SSPC-SP1 Solvent Cleaning", hereinafter called "SP1"; "SSPC-SP3 Power Tool Cleaning", hereinafter called "SP3"; and "SSPC-SP6 Commercial Blast Cleaning", hereinafter called "SP6".

C. INSPECTIONS & TESTING
1. Cooperate with inspector; permit inspector's access to all places where work is being done.
2. Welding: Verify conformance with applicable Sections of Division 5. All welding shall be subject to special inspection.
3. Structural Steel Framing & Fabrications:
   a. General: Tests will be performed as required by the International Building Code, Chapter 17, as adopted by local jurisdiction and these specifications.
   b. Shop Bolted Connections: Inspect in accordance with AISC specifications.

c. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
   i. Verify use of certified welders, and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   ii. Perform visual inspection of all welds including fillet welds.
   iii. Perform tests of complete penetration welds as required by technical specifications as follows. Inspection procedures listed are to be used at Testing Laboratory's option.
      1) Radiographic Inspection: ASTM E94; minimum quality level "2-2T".
      2) Ultrasonic Inspection: ASTM E164.
      3) Magnetic Particle Testing: ASTM E1444
d. Field Bolted Connections: Inspect in accordance with AISC specifications.
e. Field Welding: Inspect and test during erection of structural steel as follows:
   i. Verify use of certified welders, (AWS "Standard Qualification Procedure) and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies and submit copies of such reports to Contractor, Architect, Owner, Structural Engineer, and Local Building Department.
   ii. Perform visual inspection of all welds including fillet welds.
   iii. Perform tests of full penetration welds as required by technical specifications as follows:
      1) Radiographic Inspection: ASTM E94; minimum quality level "Z-2T".
      2) Ultrasonic Inspection: ASTM E164.
      3) Magnetic Particle Testing: ASTM E1444
f. Testing Program Summary: Testing agency special inspector shall submit a summary of the proposed testing program for review and approval; submit directly to Contractor, Architect, Owner, Structural Engineer, and Local Building Department.

D. QUALIFICATIONS

1. Fabricator/Erector: Shall have AISC Building Fabricator Certification. Shall have appropriate facilities and an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section as indicated on Drawings. Shall have minimum of five (5) years of experience and be able, upon request, to show framing of size, materials, and scope similar to work of this Contract.
2. Welders: Shall be certified by the American Welding Society (AWS). Welders of structural steel shall have qualification as required by AWS D1.1. Each welder shall mark his identification symbol on his work.

E. CONNECTION IDENTIFICATION

1. Each person installing connections shall be assigned an identifying symbol or mark, and all shop and field connections shall be so identified so that the Owner's independent testing agency can refer to the person making the connection.

1.3 SUBMITTALS

A. SHOP DRAWINGS

1. Furnish complete, checked shop drawings for approval.
2. Include complete information for the fabrication and erection of the structure's components, including all required dimensions, details, necessary accessory items as described in the Standard No. 1. Show sizes, configurations, spacing and location of trusses, connections, bridging, reinforcing, anchoring, cambers, loads, and other

pertinent data, and showing welded connections and the length thereof, using AWS standard welding symbols in accordance with AWS 2.4. Clearly designate all portions of members, connections, and welds which are required to be fabricated and handled per the requirements for architecturally exposed structural steel (AESS).

3. Provide framing plans showing locations and sizes of holes in beam webs for coordination with sprinkler pipe layouts.
4. Provide setting drawings, templates, and directions for installing anchor bolts and other required anchors.
5. Include with each detail shown on the shop drawings a reference to the Architect's and Structural Engineer's drawings and details, where applicable.
6. Calculate, obtain, and show all additional dimensions required which are not otherwise specifically set forth on Drawings. Coordinate dimensions with all connected and adjacent work. Verify all applicable dimensions.
7. Include manufacturer's specifications and other data needed to prove compliance with specified requirements.
8. Piece mark notations shall be indicated on layout drawings.
9. Shop drawings shall not be reproductions of Contract Drawings.
10. Shop drawings are interpretations of and are supplemental to the design drawings and specifications. Their intent is to demonstrate to the Architect that this Contractor has understood the design concept, and to provide detailed information necessary for the fabrication, assembly, and installation of the products and materials specified. Neither the shop drawings nor comments placed on them by the Architect shall be construed as being change orders.

B. CERTIFICATIONS

1. Submit certification of materials with copies of mill reports for each heat and type of steel used.
2. Submit complete manufacturer's mill test reports for bolts, nuts and washers. Markings and chemistry shall also comply with specification. Certification numbers shall appear on product containers and correspond to certification numbers on mill test report to be accepted. Mill test report shall be supplied to both the purchaser and Owner's independent testing agency.

C. PLACEMENT PLANS

1. Submit placement plans and details as required for the satisfactory placing, connection, and anchorage of all structural members.

D. WELDING PROCEDURES

1. Submit detailed welding procedures in accordance to ASW D1.1. Submit to the Owner's independent testing agency the detailed description of welding procedures proposed for use on structural metals. Obtain approval prior to any welding operation. Furnish joint welding procedure qualification tests, as required by AWS D1.1.

1.4 PRODUCT DELIVERY, STORAGE & HANDLING

A. Stacking & Shipping

1. Handle and stack all materials carefully to prevent deformation or damage. Store all structural steel members carefully on substantial timbers and blocking, so arranged that the steel will be properly drained. Special care shall be taken to avoid any twisting, deformation, or damage to the surface of members designated as architecturally exposed structural steel.
2. Deliver materials to the job site properly marked to identify the location for which they are intended.

3. Use markings corresponding to markings shown on the reviewed Shop Drawings.
4. Keep primed steel members from touching each other by using wooden separators for stacking. Take measures to avoid damaging prime coat while stacking, loading or unloading and use wooden protectors to prevent damage from chain or cable cinches. Provide special protection and handling of all members designated as architecturally exposed structural steel.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Architecturally Exposed Structural Steel: All steel and connections which will be exposed in the final construction shall be designated as architecturally exposed structural steel (AESS).

B. Structural Steel

1. Provide carbon steel shapes, plates, and bars of structural quality, sizes, and types noted on Drawings and specified herein, for use in welded and bolted construction. Steel manufactured by the Acid Bessemer process shall not be used for structural purposes. Steel which, in the opinion of the Owner's independent testing agency, is badly corroded or physically damaged shall not be incorporated in the work.
   a. Shapes, Threaded Rods and Plates: All 'W' and 'H' shapes shall conform to ASTM A992, Grade 50. All other pieces ASTM A36, Grade 36, unless otherwise noted on Structural Drawings.
   b. Steel Tubing: ASTM A500 Grade C, Fy = 50 ksi unless otherwise noted on Drawings.
   c. Steel Pipe: Unless otherwise shown on Drawings, ASTM A53, Type E or S, Grade B, Fy = 36 ksi.
   d. Substitutions: Should substitutions be required due to non-availability of sections shown, obtain Architect's prior approval. No substitutions permitted with members lighter in weight than shown on Drawings.

D. Fasteners

1. Standard Fasteners: Low-carbon steel externally and internally threaded fasteners conforming to requirements of ASTM A307, Grade A except as otherwise noted on Structural Drawings. All bolts, nuts and washers exposed to the weather shall be hot-dipped galvanized.
   a. Anchor Bolts: Headed type with heavy hexagonal nuts for all connections unless otherwise indicated. Include lock washers under nuts or self-locking nuts. Anchor bolts shall conform to ASTM F1554 Grade 36, unless noted otherwise.
   b. Unfinished Threaded Fasteners: Provide either hexagonal or square heads and nuts; except use only hexagonal units for exposed connections.
2. High-Strength Fasteners: Quenched and tempered steel bolts and nuts conforming to requirements of ASTM A325 or A490, or as otherwise noted on Structural Drawings. Provide heavy hexagonal head bolts and nuts and hardened steel washers. Load indicator washers conforming to ASTM F959 or tension control bolts shall be used. All bolts, nuts and washers exposed to the weather shall be hot-dipped galvanized.
3. Drilled-in-Concrete Expansion Anchors: Shall be Hilti concrete anchors as manufactured by Hilti Corporation, or Simpson Strong-Tie, or equal having ICC approval, of the type noted on Structural Drawings.

E. Steel Stud Anchors

1. All steel stud anchors welded to steel beams or embedded items for concrete connections shall be "Nelson Studs" as manufactured by Nelson Stud Welding Division,

headed concrete anchors by Welding Products, Inc., or equal. Install as indicated on Drawings, automatically end-welded in shop or field with equipment recommended by manufacturer of studs.

F. Weld Electrodes

1. For base metal conforming with ASTM A36, A53, A500 and A992 Gr50, use E70xx series electrodes in accordance with AWS A5.1 or AWS A5.5.
2. Electrodes for welding A706 rebar shall comply with the filler metal requirements of AWS D1.4, Table 5.1.
3. Weld filler metal for components and connections of the seismic force resisting system shall have a minimum specified yield strength of 70,000 psi and shall conform to the requirements of AWS D1.8 clauses 6.1, 6.2, and 6.3.

G. Zinc Coating

1. All structural steel where noted, shall be galvanized by the "hot-dip" method in accordance with ASTM A123, of the following coating weights per square foot of actual surface:

Steel under 1/16"	:	1.1 oz. average, 1.8 oz. min.
Steel 1/16" to under 1/8"	:	1.5 oz. average, 1.8 oz. min.
Steel 1/8" to under 1/4"	:	2.0 oz. average, 1.8 oz. min.
Steel 1/4" and heavier	:	2.3 oz. average, 2.0 oz. min.

2. Galvanize bolts and similar threaded fasteners in accordance with ASTM A153, Class A, B, C and D, as applicable.
3. Steel pipe shall be galvanized in accordance with ASTM A53.
4. Furnish certificate from plating firm attesting to conformance with Specifications for steel plates and shapes.

H. Shop Painting Materials

1. Galvanized Items: Furnish zinc-rich primer for re-galvanizing welds in galvanized steel, complying with Steel Structures Painting Council (SSPC) Painting System Guide PS12.01.
2. All Other Non-Ferrous Metal Items: Furnish Tnemec Company, Inc. "FD88 Azeron Primer", R.J. McGlennon Co. Inc “42 Series Mactek Low VOC Hight Solids Primer,” or equal. Primer shall be lead-free, high solids modified alkyd primer, meeting or exceeding performance requirements of Federal Specification TT-P-86G, Type I.
3. Portions of items to be embedded in concrete, or at high-strength bolted or welded connections: No shop painting permitted.
4. **All products shall be “0 (Zero) Lead,” utilizing the lead safe work practices identified in the EPA Guidance Document titled “Steps to Lead Safe Renovation, Repair, and Painting, pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

I. Grout For Base & Bearing Plates

1. For general use furnish Sika Chemical Corp. "Sikagrout 212" or Master Builders "Masterflow 928 Grout", or equal, "flowable" consistency, with a minimum compressive strength in 28 days of 7000 psi.

J. Other Materials

1. Provide all incidental and accessory materials, tools, methods, and equipment required for fabrication and erection of structural steel framing as indicated on Drawings.

2.2 FABRICATION

A. GENERAL

1. Fabrication and assembly shall be performed in the shop to the greatest extent possible, all in accordance with the requirements of AISC specifications and in strict accordance with the details shown on the Contract Documents or as accepted on shop drawings. Assemble and weld built-up sections by methods which will produce true alignment of axis without warp.
2. Beams and girders shall be upward cambered where indicated on Drawings. For beams and girders without specified cambers, fabricate members so that after erection, any minor camber due to rolling or fabrication is upward.
3. Identify all steel at mill, showing grade and yield points.
4. Properly mark and match-mark materials for field assembly and for identification as to location for which intended.
5. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
6. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations.
7. Provide finish surfaces of members exposed in the final structure free from markings, burrs, and other defects.

B. STRAIGHTENING MATERIAL

1. If rolled sections are not straight within the tolerances allowed by ASTM A6, straighten by methods not injuring the metal, as approved. Examine all straightened material prior to fabrication for signs of distress or other defects; no distressed or otherwise defective material will be accepted.

C. OPENINGS & HOLES

1. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, only as approved by the Structural Engineer as shown on the Drawings and on the reviewed Shop Drawings.
2. Provide threaded nuts welded to framing, and other specialty items as shown, to receive other work.
3. Cut, drill, or punch holes perpendicular to metal surfaces.
4. Do not flame cut holes or enlarge holes by burning.
5. Drill holes in bearing plates.
6. All holes and openings not indicated on Structural Drawings shall be approved by Structural Engineer.
7. No sharp bends or kinks will be allowed.
8. The Contractor shall include provisions in the bid for holes for sprinkler piping to be placed through steel beams and girders in locations as directed by the Structural Engineer.
9. The Contractor shall verify that the beam web hole layout shown on the plans is compatible with the final sprinkler piping layout prior to fabrication. Any change from the hole layout shown on the plans shall be approved by the Structural Engineer.

D. CONNECTIONS

1. Provide bolts and washers of types and sizes required for completion of field erection. Form connections as detailed; make all shop connections by welding or bolting as approved on shop drawings.
2. High strength bolted construction:
   a. Install high strength threaded fasteners in accordance with AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts," using fully pre-tensioned bolts.
   b. Use A325-N bolts unless noted otherwise on the Drawings.
3. Welded construction: Comply with AWS Code for procedures, appearance, and quality of welds, and methods used in correcting welded work.

4. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
5. No combination of bolts and welds shall be used for stress transmission in the same faying face of any connection without prior approval by the Structural Engineer.

E. WELDING

1. Conform to Standards No. 1 and No. 2 as applicable. All welding shall be in accordance with the "Structural Welding Code", ANSI/AWS D1.1, and shall be performed by certified welders.
2. Welding processes other than shielded metal arc, submerged arc, and flux cored arc may be used, provided procedure qualification tests in accordance with the AWS are made for the intended application of all such processes.
3. Built-up sections assembled by welding, when present, shall be free of warpage, and all faces shall have true alignment.
4. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS, except make all structural steel welds not less than 3/16 inch, unless noted otherwise. Note on shop drawings when assumption of weld is used for review of conformance.
5. Welding sequences, pre-post-heat methods, and detailing of joints shall be such as to reduce the residual stresses to a minimum.
6. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.
7. Prepare and clean sharp edges to be joined of all oil, grease, scale, and rust in accordance with AWS D1.1.
8. Remove all slab or flux remaining on any bead before proceeding. Remove any cracks or blow holes that appear on any bead by chipping, grinding, or arc-gouging before proceeding.
9. In galvanized steel work, touch-up surfaces damaged by welding with zinc-rich primer complying with SSPC-PS12.01.
10. Welding of architecturally exposed structural steel (AESS) shall conform to the welding requirements for AESS in Standard No. 2. Additionally, welds which are exposed to view in the final building shall be ground smooth to a throat depth not less than specified in the plans and specifications.

F. FINISHING

1. Prepare compression joints depending upon contact bearing to common plane by milling, sawing or approved means.
2. Architecturally exposed structural steel shall be finished to be free from scratches, burrs, rust, pitting and other defects, per the AISC requirements and as directed by the Architect.

G. STEEL STUD & DEFORMED BAR ANCHORS

1. All anchors shall be automatically end-welded in the shop or field with equipment recommended by the manufacturer of the studs and by qualified welders. Steel stud material, welding, and inspection shall be in accordance with AWS D1.1. End-weld in such a manner as to provide complete fusion between the end of the stud and the plate. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate.

H. TOLERANCES, STRAIGHTNESS & LENGTH

1. Conform to Standard No. 1.
2. Fabrication tolerances for architecturally exposed structural steel (AESS) shall conform to the requirements for AESS given in Standard No. 2.

I. SHOP PAINTING

1. Work Not Requiring Shop Painting:
   a. Shop painting not required on steel to be hot-dipped galvanized, encased in concrete or masonry, or covered with spray-applied fireproofing.
   b. Do not shop paint surfaces of steel elements where a field weld or a high-strength bolt connection is to be applied.
2. Surfaces Requiring Shop Painting:
   a. Except for members specified above, all other surfaces shop painted after fabrication, before leaving fabricator's shop.
   b. Paint embedded steel which is partially exposed in the exposed portions, and the initial 2" of embedded areas only.
   c. Shop painting of architecturally exposed structural steel (AESS) shall be per the Architect's requirements for each member.
3. Surface Preparation:
   a. General: After fabrication, clean surfaces free of all mill scale, rust, oil, grease, weld slag, flux deposit, dirt and other foreign matter. Clean and prepare surfaces in exterior work in accordance with SSPC Specification SP6. Clean and prepare surfaces in interior work in accordance with SSPC Specification SP3.
   b. Inaccessible Finished Surfaces: Except for contact surfaces as specified below, surfaces inaccessible after shop assembly shall be cleaned and prime painted as specified herein, prior to assembly. Apply two (2) coats; change color of the second coat to distinguish it from first coat.
   c. Contact Finished Surfaces: Conform to Standard No. 1; clean and prepare surfaces in accordance with SSPC standards SP1 and SP3.
   d. Surfaces Adjacent To Field Welds: Conform to Standard No. 1.
4. Shop Painting, Material and Application: Paint with one coat of primer specified above, except two (2) coats at inaccessible finished surfaces, by brush, spray, roller coating, flow coating or dipping at Contractor's option, applied to an even consistency to provide a uniform dry film thickness of not less than 1.5 mils per coat. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer.
5. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated. **In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in theEPA Guidance Document titled "Steps to Lead Safe Renovation, Repair, and Painting," pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior Work

1. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
2. In the event of discrepancy, immediately notify the Architect.
3. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 STRUCTURAL METAL ERECTION

A. General

1. Comply with AISC specifications and "Code of Standard Practice," except as may be modified herein. Coordinate as required with other trades to assure proper and adequate

provisions in the work of those trades for interface with the work of this Section. Exercise care to prevent damage due to handling, dropping or placement of members.

2. Furnish anchor bolts and templates, and other items as indicated, to other Sections for installation prior to placement of concrete.
3. Install the work of this Section in strict accordance with the original design, the approved shop drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturers recommended installation procedures as approved by the Architect.
4. Install in accurate locations and to lines and elevations indicated. Align and adjust members forming part of a complete frame or structure before fastening permanently. Adjust and shim as required to compensate for discrepancies in elevation and alignment. Level and plumb individual members of the structure within AISC tolerances; final assembly shall produce true alignment of axis without warp.
5. Erection of architecturally exposed structural steel (AESS) shall meet the require,ents given for AESS in Standard No. 2. AESS shall be unloaded, handled, and erected to avoid marking or distorting members.
6. Weld, securely anchor and install bracing and/or bridging before applying any loads, except the weight of the erectors. Anchor all components firmly into position for long life under hard use.
7. Tighten and leave erection bolts in place after welding. Where high-strength bolts are required, provide identified and marked bolts. Install using procedure as hereinafter specified; mark tightened bolts.
8. Drift pins shall not be used to enlarge unfair holes in main material. Holes that must be enlarged shall be reamed up to a maximum of 1/16th of an inch larger to admit bolts. Burning, drifting and reaming may be used to align unfair holes in members only after approval by the Owner's independent testing agency.
9. Furnish shim plates or develop fills where required to obtain proper fit and alignment.
10. Mutilate threads or use lock nuts for unfinished bolts to prevent nuts from backing off. Draw unfinished bolt heads and nuts tight against the work.
11. Temporary erection angles and tack welds may be used to provide temporary support for architecturally exposed structural steel during erection. Temporary angles shall be removed and tack welds ground smooth after member is secured.

B. Anchor Bolts

1. Provide anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
2. Provide templates and other devices necessary for presetting bolts and anchors to accurate locations.

C. Bases and Bearing Plates: Shop weld to columns and members attached to concrete.

D. Splicing

1. Splice members only where indicated unless, with the Architect's approval, splices not indicated would result in lower costs due to reduced shipping expense.
2. For splices not indicated, submit structural calculations prepared and signed by a structural engineer licensed to practice in the State of Nevada.
3. Fasten splices of compression members after bringing abutting surfaces completely into contact. Make all field connections by high-strength bolting or welding, unless otherwise noted.

E. Gas Cutting

1. Do not use gas cutting torches for correcting fabricating errors in the structural framing.
2. Cutting will be permitted only in secondary members as acceptable to the Architect.
3. When gas cutting is permitted, finish the gas cut section to a sheared appearance acceptable to the Architect.

F. Surveys

1. Establish permanent benchmarks necessary for accurate erection of structural steel.
2. Check elevations of concrete surfaces, and locations of anchor bolts and similar items, before erection proceeds.
3. Submit erection survey data to the Architect for review; to validate plumbness of the structural steel frame and to verify compliance with AISC erection tolerances.

G. Temporary Shoring and Bracing

1. Conform to Standard Nos. 1 and 2, as applicable.
2. Temporary bracing and guys shall be introduced wherever necessary to provide for loads and stresses to which the structure may be subjected, including those due to erection equipment and their operation and shall be left in place as long as it may be necessary for safeguarding all parts of the work.
3. Provide supplemental structural steel support framing for metal decking where deck bearing is precluded by column flange plates or other framing members. Remove temporary connections and members when permanent members are in place and the final connections have been made.

H. Setting Bases and Bearing Plates

1. Clean concrete bearing surfaces free from bond-reducing materials, and then roughen to improve bond to the surface.
2. Clean the bottom surface of base and bearing plates.
3. Set loose and attached base plates and bearing plates for structural members in wedges or other adjusting devices.
4. Tighten anchor bolts after the supported members have been positioned and plumbed.
5. Do not remove wedges or shims but, if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
6. Pack grout solidly between bearing surfaces and bases or plates to assure that no voids remain.
7. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's recommendations as approved by the Architect.

I. Field Assembly

1. Set structural frames accurately to the lines and elevations indicated.
2. Align and adjust members forming part of a complete frame or structure before fastening permanently.
3. Clean the bearing surface, and other surfaces which will be in permanent contact, before assembly.
4. Adjust as required to compensate for discrepancies in elevation and alignment.
5. Level and plumb individual members of the structure within specified AISC tolerances.
6. Establish required leveling and plumbing measurements on the mean operating temperature of the structure, making allowances for the difference between temperature at time of erection and the mean temperature at which the structure will be when completed and in service.
7. Comply with AISC specifications for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to welds.

3.3 TESTING AND INSPECTING

A. Testing

1. Costs of tests of identified stock will be paid by the Owner; except that if a test fails to comply with the specified requirements, the cost of testing will be paid by the Owner and back charged to the Contractor.
2. Costs of tests of unidentified stock will be paid by the Owner and back charged to the Contractor.
3. Test of mill order steel: Where structural steel, ordered from the mill and cut to lengths, is identified by heat or melt numbers and is accompanied by mill analysis or test reports, such material shall be used without further local test, provided an affidavit is given that the materials conform with the requirements of these Specifications. In case of controversy, tension and bend tests of the material either locally or at the mill, as required for local stock will be required.
4. Tests of unidentified steel: Where steel cannot be identified or its source is questionable, have one set of physical tests made for each 5 tons, or fraction thereof, for each size member and appropriately mark the steel to identify it with the test specimen. Have testing laboratory check the stock, select and mark test specimens, and make the required laboratory tests. Miscellaneous steel items such as angle clips, anchors and inserts need not be tested when Contractor submits written warranty as to their quality. Test reports shall be acceptable to the Architect prior to fabrication.
5. Additional tests may be required when deemed necessary by the Architect.

B. Inspecting

1. A complete four sided inspection of steel will be made when required by the Architect.
2. Cost of inspecting will be paid by the Owner subject to the same provisions made above for tests.
3. If, after fabrication and inspection, the work of this Section is found to be defective and to require reinspection, cost of such reinspection will be paid by the Owner and back charged to the Contractor.
4. Provide labor, equipment, and facilities needed to move and handle the materials to be inspected.

C. Welding Inspection

1. Unless otherwise specified, perform welding under observation of a qualified inspector from a testing laboratory approved by the Architect.
2. Inspect every layer of weld for quality, penetration, and conformity with design requirements.
3. Require the welding inspector to submit a signed report to the Architect, verifying that:
   a. The welding is adequate and was performed in conformity with the specified requirements; and
   b. Adequate methods have been used to determine the quality of the welding.
4. The welding inspector may use gamma ray, magnaflux, trepanning, or any other aid to visual inspection considered necessary to assure adequacy of welding or may use ultrasonic testing performed in accordance with pertinent requirements of governmental agencies having jurisdiction.
5. Cost of initial welding inspection will be paid by the Owner. If the welds fail the inspection, the cost of additional welding inspection will be paid by the Contractor.

D. Access

1. Provide access for the testing agencies and inspectors to places where structural steel work is being fabricated or produced, so that required testing and inspecting may be accomplished.

E. Erection Inspection

1. The Owner's testing and inspecting agency will inspect field welded connections, will perform such additional tests and inspections of field work as are required by the Architect, and will prepare test reports for the Architect review.
2. The testing agency will conduct and interpret the tests and will state in each report whether the inspected work complies with the requirements, specifically stating all deviations therefrom.

F. Corrections

1. Correct deficiencies in structural steel work which inspections and test reports indicate to be not in compliance with the specified requirements.
2. Perform additional tests required to reconfirm noncompliance of the original work and to show compliance of corrected work, all at no additional cost to the Owner.

3.4 FIELD PAINTING & FINAL CLEANING

A. Field Painting

1. General
   a. All bare steel surfaces and welds, except those to receive other coatings, which remain after installation shall be field painted at all locations both exposed and concealed in the finished Work.
   b. Prepare surface in a manner appropriate to the condition, and as approved by the Architect.
   c. Clean spots and surfaces where primer coats have been removed, damaged, or burned off, and clean field bolts and other field connections.
   d. Remove dirt, oil, and grease.
   e. Apply one spot coat of the approved primer.
   f. Do not apply paint to wet, damp, oily, or improperly prepared surfaces.
2. Application – Notify the Architect when the work of this Section is ready to receive field painting.
   a. Secure inspection and approval by the Architect prior to field painting.
   b. Using spray or brush, as recommended by the manufacturer of the approved paint material, fill all joints and corners and cover the surfaces with a smooth unbroken film of at least 1.5 dry mils thickness, for each of the two required coats.
   c. Comply with manufacturer’s written instructions and recommendations in “MPI Architectural Painting Specification Manual” applicable to substrates indicated. **In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in theEPA Guidance Document titled “Steps to Lead Safe Renovation, Repair, and Painting,” pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

B. Final Cleaning

1. As erection on each floor or area is completed, steel surfaces to receive sprayed-on fireproofing shall be left clean as previously specified.

END OF SECTION 05 10 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Drawings and general provisions of the Contract Documents including General, Supplemental and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. The extent of the miscellaneous metal work is indicated on the drawings, which includes, whether specified herein or not, all items fabricated from iron and steel shapes, plates, bars, strips and pipes which are not a part of structural steel or other metal systems in other sections of these specifications.

C. Related Sections

1. Division 3 Section “Cast-in-Place Concrete” for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
2. Division 5 Section “Structural Steel”
3. Coordinate with all applicable sections of these specifications for related work where miscellaneous metals work is to be used.

1.2 QUALITY ASSURANCE

A. Standard Specifications: Comply with the provisions of the following codes, standards and specifications, except as otherwise shown or specified:

1. AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings”, and including “Commentary of the AISC Specifications”.
2. AISC “Specification for the Design of Cold-Formed Steel Structural Members”.
3. AWS “Structural Welding Code”.

B. Qualifications for Welding Work

1. Qualify welding processes and welding operators in accordance with the AWS “Standard Qualification Procedure”.

1.3 SUBMITTALS

A. Manufacturer’s Data

1. Submit manufacturer’s specifications, dimension diagrams, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work, including paint products.

B. Shop Drawings

1. Submit **complete**, checked shop drawings.

2. Include shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work, which are not completely shown by the manufacturer's data sheets.
3. Include all details, elevations, welding and other connections, zinc-coating and shop painting information and dimensions; coordinate with connecting and adjacent work; show anchorage and accessory items.
4. Include plans and elevations at not less than 1" to 1'-0" scale and include details of sections and connections at not less than 3" to 1'-0" scale.
5. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by other trades.
6. Shop drawings are interpretations of and are supplemental to the design drawings and specifications. Their intent is to demonstrate to Architect that this Contractor has understood the design concept, and to provide detailed information necessary for the fabrication, assembly, and installation of the products and materials specified. Neither the shop drawings nor comments placed on them by the Architect shall be construed as being change orders.

1.4 JOB CONDITIONS

A. Field Measurements

1. Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

B. Inserts & Anchorages

1. Furnish inserts and anchoring devices which must be set in concrete and/or welded to building components for the installation of miscellaneous metal work. Coordinate delivery with other work to avoid delay.

C. Shop Assembly

1. Pre-assemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site.
2. Disassemble units only to the extent necessary for shipping and handling limitations.
3. Clearly mark units for re-assembly and coordinated installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials – General

1. Metal Surfaces, General: For the fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coatings.
2. Steel Plates, Shapes and Bars: ASTM A36.
3. Steel Plates to be Bent or Cold-Formed: ASTM A283, Grade C.
4. Cold-Finished Steel Bars: ASTM A108, grade as selected by fabricator.
5. Hot-Rolled Carbon Steel Sheets and Strips: ASTM A568 and ASTM A569; pickled and oiled.
6. Cold-Rolled Carbon Steel Sheets: ASTM A 366.

7. Galvanized Carbon Steel Sheets: ASTM A653, with hot-dip galvanized coat complying with ASTM A924, G90.
8. Steel Pipe: ASTM A53, type as selected; Grade A; black finish; standard weight (schedule 40), except where otherwise shown or specified as stronger.
9. Steel Tubing: ASTM A500, Grade C, Grade 50.
10. Stainless Steel: Type 304, ASTM A167, with AISI 2D finish, deal soft, fully annealed.
11. Aluminum: Furnish extruded shapes of 6061-T6 alloy, of gauges, shapes and sizes required, unless otherwise specifically specified herein.

B. Anchors

1. Threaded-Type Concrete Inserts: Galvanized ferrous castings, internally threaded to receive machine bolts; malleable iron ASTM A27; hot-dip galvanized.
2. Wedge-Type Concrete Inserts: Box-type ferrous castings, designed to accept bolts having special wedge-shaped heads; malleable iron ASTM A47, or cast steel ASTM A27; hot-dip galvanized.
3. Slotted-Type Concrete Inserts: 1/8" thick pressed steel plate, ASTM A283; box-type welded construction with slot design to receive square head bolt and with knockout cover; hot-dip galvanized.

C. Fasteners

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls.
2. Standard Bolts and Nuts: ASTM A307, Grade A, regular hexagon head.
3. Lag Bolts: Hex head type complying with Federal Spec FF-B-561.
4. Machine Screws: Cadmium plated steel complying with Federal Spec FF-S-111.
5. Plain Washers: Round, general assembly grade carbon steel complying with Federal Spec FF-W-92.
6. Lock Washers: Helical spring type carbon steel complying with Federal Spec FF-W-84.

D. Zinc Coating

1. Except as further specified below, where noted in this Section that ferrous metal items are to be zinc-coated or galvanized, provide by the "hot-dip" method, in accordance with ASTM A123, of the following coating weight per square foot of actual surface:
   Steel under 1/16" : 1.1 oz. average, 1.8 oz. min.
   Steel 1/16" to under 1/8": 1.5 oz. average, 1.8 oz. min.
   Steel 1/8" to under 1/4" : 2.0 oz. average, 1.8 oz. min.
   Steel 1/4" and heavier : 2.3 oz. average, 2.0 oz. min.
2. Galvanize bolts and similar threaded fasteners in accordance with ASTM A153, Class A, B, C and D, as applicable.
3. Steel pipe shall be galvanized in accordance with ASTM A53.
4. Steel sheet in coils and cut lengths shall be galvanized in accordance with ASTM A924, G-60 or G-90 specifications, as applicable.
5. Furnish certificate from plating firm attesting to conformance with Specifications for steel plates and shapes.

E. Metal Primer Paint

1. Zinc-Coated (Galvanized) Material: Not required, except furnish zinc-rich primer for re-galvanizing welds in galvanized steel, complying with Steel Structures Painting Council (SSPC) Painting System Guide PS12.01.
2. All Other Ferrous Metals - Concealed in the Completed Work: Furnish Tnemec Company, Inc. "FD88 Azeron Primer", or approved equal, lead-free, high solids primer, meeting or exceeding performance requirements of Federal Specification TT-P-86G, Type I. At fabricator's option, primer as specified below for 'exposed' applications may be used for 'concealed' work.

3. All Other Ferrous Metals - Exposed in the Completed Work: Furnish Tnemec "Series 37 Chem-Prime" or Sherwin Williams "Kem Kromik Universal Metal Primer", or equal, chromate-free rust inhibitive universal alkyd-phenolic primer compatible with high performance primer and finish coats as specified.
4. **All products shall be "0 (Zero) Lead," utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair, and Painting, pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

F. Grout for Installation of Metal Fabrication

1. For general use, furnish Master Builders "Masterflow 928 Grout", "Euco N-S" (non-metallic) by the Euclid Chemical Company, or equal, "flowable" consistency, with a minimum compressive strength in 28 days of 7000 psi.

2.2 FABRICATION - GENERAL

A. General

1. Use materials of the size and thicknesses shown or, if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of the work.
2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work; punch and shear leaving clean and true surfaces.
3. Weld corners and seams continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.
4. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown or, if not shown, use Phillips flathead (countersunk) screws or bolts.
5. Provide holes, cuts and connections, where shown, for work of other trades. Provide for anchorage of the type shown, coordinated with the supporting structure and the progress schedule. Fabricate and space anchoring devices as shown and as required to provide adequate support for the intended use of the work.
6. Use hot-rolled steel bars for work fabricated from bar stock, unless work is indicated to be fabricated from cold-finished or cold-rolled stock.
7. Detail joints and fastenings for ample strength and stiffness as shown or approved; conceal fastenings wherever possible.
8. Form joints to exclude water, where exposed to elements.

B. Shop Painting

1. Zinc-coated (galvanized) material: Where required on plans.
2. All other ferrous metals:
   a. Remove all mill scale, rust, loose rust, oil, grease, dirt and foreign matter. Clean and prepare surfaces in exterior work in accordance with SSPC Specification SP6. Clean and prepare surfaces in interior work in accordance with SSPC Specification SP3.
   b. Apply one brush or airless spray coat primer coating of applicable type as specified above, as applicable, applied to all exposed surfaces after fabrication, dry film thickness as specified above.

3. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated. **In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair, and Painting," pages 12 through 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

2.2 FABRICATION – MISCELLANEOUS STEEL ITEMS

A. Railings, Handrails & Guardrails

1. General:
   a. Fabricate from ASTM A53 schedule 40 "standard" steel pipe and ASTM A36 steel plate, bar, rod and angle members of sizes and configurations shown for the various exterior and interior conditions and applications, all joints welded and ground smooth.
   b. Fabricate guardrails, railings and handrails accurately, level with finish floor or sloped to match angle of stair and ramp construction, as applicable. Radius steel pipe handrails and railings at corners and ends as shown.
   c. Jointing of posts, rail and corners, except radiused corners, shall be by mitered and welded joints made by fitting vertical posts to top rail and intermediate rails to vertical posts, mitering corners, except radiused corners, groove welding joints, and grinding smooth. Radiused corners shall be bent to shapes indicated, with bends made in a suitable jig such that pipe is not crushed.
   d. Exposed ends of rails, closed, welded and welds ground smooth.
   e. Vertical members of railings one piece to underside of top rail.
   f. After fabrication, galvanize exterior members, where so indicated by the Architect.
2. Pipe Sleeves for Vertical Members Set in Concrete: Fabricate from galvanized steel pipe to size shown, for recessed installation in concrete.
3. Pipe Plate Supports for Vertical Members Set on Steel Framing: Fabricate from steel plate to size and shape shown, complete with threaded studs with bolts welded to bottom side, for securing to steel framing.
4. Pipe Plate Supports for Vertical Members Returns at CMU Walls: Fabricate integral with railing supports from steel plate to size and shape shown, welded to railing returns, complete with holes for threaded anchor bolts set in masonry wall.
5. Handrail Brackets: For handrails mounted to steel framing, concrete or masonry wall construction, provide of radiused 3/4-inch round steel rod, formed to size and shape as detailed, complete with steel plate mounting flange.

B. Steel Sign Posts

1. Provide of 6 inch diameter ASTM A53 schedule 40 steel pipe together with 4x4 inch tube steel, lengths as required for mounting handicap and other various traffic control signs to heights above grade as indicated on Civil Drawings.
2. Drill holes of size and in locations required for signs as indicated, ready for installation of signs.
3. Furnish complete with welded cap plate as shown.
4. Galvanize steel pipe and tube steel post members inside and out after fabrication.

C. Fixed and Removable Steel Pipe Bollards

1. Provide ASTM A53 schedule 40 steel pipe, diameter and length as required for conditions shown.
2. Unless otherwise shown, bollards shall extend 3'-6" above adjacent finish grade and set in concrete footing as detailed and specified below.

D. Roof Access Ladders

1. Fabricate accurately of mild steel flat bars and rods as detailed, all joints welded and ground smooth, of sizes, lengths and configurations shown or otherwise required for roof access and elevator pit access locations.
2. Unless otherwise shown on Drawings, vertical members and bent flat bar support bracket members 3/8 x 2 inch material; vertical members spaced apart as shown on applicable details; support bracket spaced as shown.
3. Rungs: 1 inch square bars, unless otherwise shown, spaced on 12 inch centers, mortised into vertical members and welded.
4. Siderails shall be spaced 16” apart, unless otherwise noted.
5. Support to walls shall be provided at top and bottom and not more than 60” o.c. with welded or bolted steel brackets.
6. Prime paint steel members after fabrication.

E. Louver Frame Stops

1. Fabricate from ASTM A36 steel angle and flat bar members of sizes and to configurations shown or otherwise required for each wall louver opening, with all connections fully welded and ground smooth; refer to applicable details in Project Manual Volume II, plus related drawings and details.
2. Drill holes of size and in locations required for bolted connections and for securement of louvers.
3. All steel members galvanized after fabrication.

F. Other Items

1. Furnish all other miscellaneous metal fabrication items shown on Drawings and not classed as structural steel. Generally this includes steel angle jamb supports for overhead coiling door and shutter guides, and the like. Fabricate accurately.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete construction. Coordinate the delivery of such items to the project site.

3.2 SURFACE CONDITIONS

A. Prior to installation of work in this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where installation of the work of this Section may properly commence

B. Verify that miscellaneous metal items have been fabricated for installation in strict accordance with the original design and the approved shop drawings.

C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation of miscellaneous metal items in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 MANUFACTURED ITEMS

A. Immediately after erection, clean the field welds, bolted connections, and abraded areas of shop rimming. Paint the exposed areas with same material used for shop priming, to the same required thickness.

3.4 INSTALLATION – FABRICATED ITEMS

A. Installation - General

1. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal item to in-place construction; including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.
2. Cutting, fitting & placement:
   a. Perform all cutting, drilling, and fitting required for installation of the miscellaneous metal items. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
   b. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
   c. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
   d. Grind joint smooth and touch-up shop paint coat.
   e. Do not weld, cut or abrade the surfaces of units which have been hot-dip galvanized after fabrication, and are intended for bolted field connections.

B. Guardrails, Railings & Handrails

1. Erect guardrails, railings, and handrails as detailed and shown on Drawings and applicable Details for the various construction types and conditions, in all locations shown on Drawings, true to line.
2. Set vertical members into pipe sleeves where set in concrete, secured with metal wedges and grout with "Por-Rok" or approved non-shrink grout; slope top of grout to drain away from pipe support.
3. Secure guardrails and stair handrails and railings with brackets secured to wall construction as shown for the various conditions.
4. Fully weld vertical members to steel edgings and stringer supports as shown and otherwise required for metal structures.

C. Steel Sign Posts

1. Install sign posts at the various site locations as shown and directed by Architect, set in concrete and conforming to the following requirements:
   a. Do not set posts prior to completion of final grading.
   b. Drill holes for post footings in firm, undisturbed or compacted soil.
   c. Place concrete around posts in a continuous pour, tamp for consolidation.
   d. Check each post for vertical and top alignment.

D. Steel Angle Edgings at Interior Concrete Floor Edges

1. Install as detailed and otherwise required for the conditions of the work, securely anchored to concrete floor construction as shown; coordinate with cast-in-place concrete work specified under Section 033000.

E. Roof Access Ladders

1. Install at all ladder locations shown at exterior roof access locations, securely anchored to wall and/or floor construction as required.

F. Louver Frame Stops

1. Install louver frame stops plumb, true to line, bolted to adjacent construction as shown or otherwise required for supporting wall louvers in each applicable condition; coordinate installation with light gauge metal framing work specified under Section 054000 and louver installation.

G. Other Fabricated Items

1. Install all other steel items as specified above and as otherwise shown on Drawings and not classed as structural steel.
2. Install as detailed or required for rigidity and permanence.
3. Grind all welds smooth in fabrication work to be left exposed in completed work.

H. Touch-Up Painting

1. Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal items are specified in Division 9 of these specifications.

END OF SECTION 05 50 00

SECTION 06 41 16 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Plastic-laminate cabinets.
2. Plastic-laminate/wood sink cabinets (see Drawings for construction details).

B. Related Sections:

1. Section 09 93 00 - “Staining and Transparent Finishing” for coating exposed wood cleats and supports beneath countertops.
2. Section 12 36 61 - “Solid Surfacing Countertops” for countertops installed on cabinets and for integral solid surface classroom sinks.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For panel products high-pressure decorative laminate adhesive for bonding plastic laminate solid-surfacing material cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for plumbing fixtures faucets soap dispensers and other items installed in architectural woodwork.

C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.
3. Thermoset decorative panels.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Woodwork manufacturer with not less than 5 years of production experience similar to this Project, whose qualifications indicate the ability to comply with the requirements of this section.

B. Quality Standard: Unless otherwise indicated, comply with Architectural Woodwork Standards", Edition 1 for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article A.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Softwood Plywood: DOC PS 1, Medium Density Overlay.

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi exposed edges.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

C. Wire Pulls: Back mounted, solid metal, 5 inches long, 2-1/2 inches deep, and 5/16 inch in diameter.

D. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

E. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension full-overtravel-extension type; zinc-plated steel ball-bearing slides.

F. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

G. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.

D. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.5 PLASTIC-LAMINATE CABINETS

A. Architectural Woodwork Standards Construction Style A, Frameless, Construction type I, multiple self-supporting units.

B. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.

C. All surfaces exposed to view shall receive Laminate Cladding.

D. Materials for Semi exposed Surfaces: Low-pressure melamine overlay.

E. Doors, drawer fronts, and false fronts shall be flush overlay.

F. Edge band at doors, drawer fronts, and false fronts shall be 3.0 mm thick PVC matching laminate in color, pattern, and finish.

G. Drawers:

1. Sides shall be particle board with melamine faces.
2. Bottoms shall be hardwood plywood.

H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Wilsonart Laminate: 7909-60 ‘Fusion Maple’

2.6 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

2.7 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk, and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

2.8 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 41 16

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.
2. Sound attenuation batts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than 25 and 450 when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

D. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

E. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

F. Thermal-Resistance Value (R-Value): R-value as indicated below in accordance with ASTM C518.

2.2 POLYISOCYANURATE BOARD INSULATION

A. Foil-Faced, Polyisocyanurate Board Insulation for interior application on masonry and concrete substrates: ASTM C1289, Type I, Class 2, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Chemical Company (The); THERMAX Insulation.
    b. Rmax, Inc: TSX-8500.
    c. Johns Manville: a Berkshire Hathaway Company
    d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Insulation shall meet requirements to allow for exposed use without the need for a thermal barrier. Product must meet NFPA286, FM 4880 or UL1715.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

1. Thickness: 2 inches.
2. R-Value: R-13 minimum.

2.3 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corporation
2. Johns Manville: a Berkshire Hathaway Company
3. Owens Corning

B. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Unfaced, Glass-Fiber Blanket Insulation: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

D. Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

E. Thickness: 2-1/2, 3-5/8, 6, or 8 inches as indicated on Drawings.

F. R-Value (min.):
1. 2-1/2” studs: R-7.3.
2. 3-5/8” studs: R-11
3. 6” studs: R-19
4. 8” studs: R-25

G. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D5116 and shown to emit less than 0.05-ppm formaldehyde.

2.4 ACOUSTIC BLANKET SOUND INSULATION (SOUND ATTENUATION BATTS)

A. Unfaced glass fiber acoustical insulation: ASTM C665, Type I, with maximum flame-spread and smoke-developed indexes of 10 and 10, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Owens-Corning PINK NextGen Sound Attenuation Batts

2. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

3. Min STC rating:
a. 2-1/2” studs: 39.
b. 3-5/8” studs: 49.

2.5 GLASS-FIBER ACOUSTICAL BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Knauf Insulation; ECOSE Black Acoustical Board
2. Owens Corning; SelectSound Black Acoustic Board

B. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Black Faced Glass-Fiber Acoustical Board Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

D. Thickness: 1 inch.

E. NRC: 0.75

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foil Faced, Polyisocyanurate Board Insulation:
   1. Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.
   2. Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

3.4 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Requirements:

See the following Specification Sections:

1. 03 34 50 - “Concrete Finishing”
2. 04 22 00 - “Concrete Unit Masonry”
3. 08 41 13 - “Aluminum-Framed Entrances and Storefronts”.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Butyl joint sealants.
6. Latex joint sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by the manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the owner.

1.8 DELIVERY AND STORAGE

A. Deliver all materials of this Section to the job site in the original unopened containers with all labels intact and legible at the time of use. Store only under conditions recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Definitions: The terms “sealant” and “caulk” as used herein and as shown on the Drawings shall be interchangeable and shall mean all sealing and caulking materials including elastomeric sealants, non-elastomeric sealants, acrylic sealants, mastic, adhesives, foam, firestop, primers, and back up materials required.

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

C. Size and Shape: As shown or, if not shown, as recommended by the manufacturer for the type and condition of joint, and for the indicated joint performance or movement.

D. Grade of Sealant: For each application, provide the grade of sealant (non-sag or self-leveling) as recommended by the manufacturer for the particular condition of installation (location, joint shape, ambient temperature, and similar conditions), to achieve the best possible overall performance. Grades specified herein are for normal conditions of installation.

E. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

G. Contractor shall provide the proper sealant, primer, backer rod, bond breakers and other accessories required for each different substrate and application as recommended by the manufacture for the installation.

2.2 SILICONE JOINT SEALANTS

A. Silicone, T, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; Dow Corning® 791 Silicone Weatherproofing Sealant.
b. GE Construction Sealants; Momentive Performance Materials Inc; SCS2000 SilPruf.
c. Pecora Corporation; 896-TBS
d. Sika Corporation; Joint Sealants; Sikasil WS-295
e. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; Pecora 890FTS
b. Sika Corporation; Joint Sealants; Sikasil WS-290 FPS
c. Tremco Incorporated; Spectrem
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, paintable, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; Dynatrol I-XL.
b. Sika Corporation; Joint Sealants; Sikaflex Textured Sealant.
c. Tremco Incorporated; Dymonic.
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; DOW CORNING® 786 SILICONE SEALANT -.
b. Pecora Corporation; Pecora 860.
c. Tremco Incorporated; Tremsil 200.
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Bostik, Inc; Chem-Calk 300.
b. Pecora Corporation; BC-158.
c. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; AC-20.
b. Sherwin-Williams Company (The); 850A Siliconized Acrylic Latex Caulk.

c. Tremco Incorporated; Tremflex 834.
d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.9 BOND-PREVENTATIVE MATERIALS

A. General: Use only those backup materials which are specifically recommended for this installation by the manufacturer of the sealant used, and which as nonabsorbent and nonstaining.

B. Backer-Rod: Closed-cell polyethylene foam backer-rod as a stopper or other material as recommended by the manufacturer.

C. Polyethylene Tape: Pressure-sensitive adhesive, with the adhesive required only to hold tape to the construction materials as indicated.

2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cylindrical Sealant Backing: ASTM C 1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for specific application.

C. Bond Breaker Tape: Polymer tape compatible with joint sealant materials and recommended by sealant manufactuer.

D. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

E. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean, porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Glass.
    b. Porcelain enamel.
    c. Phenolic Wall Panels.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in horizontal traffic surfaces

1. Joint Locations:

a. Isolation, control and contraction joints in cast-in-place concrete slabs.
1) Including, but not limited to sealed concrete slabs and epoxy painted concrete slabs.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, nonstaining, T
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.
c. Joints in exterior insulation and finish systems.
d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
e. Control and expansion joints in and other.
f. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: All penetrations through slab-on-grade and concrete-filled metal decks to be sealed watertight.

1. Joint Locations:

a. Joints between plumbing piping, ductwork, and electrical conduit.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints on vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
c. Perimeter joints between interior wall surfaces and frames of fire extinguisher cabinets and tackable wall surfaces.
d. All contractor-installed semi-recessed or flush-mounted items.
e. All solid surface sills, counters & backsplash: all joints and edges
f. Plywood edges (IDF, MDF & Electrical Rooms): caulk all edges before painting.
g. All joints between dissimilar materials.
h. Ceiling grids, if unable to install grid tight to wall.
i. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Exterior standard steel doors.

B. Related Requirements:

1. Section 07 92 00 - “Joint Sealants”.
2. Section 08 71 00 - "Door Hardware" for door hardware for hollow-metal doors.
3. Section 08 80 00 - “Glazing” for glazing in hollow-metal doors

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Door Components, Inc.
4. Steelcraft; an Allegion brand; Steelcraft Hollow Metal Doors and Frames

B. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
d. Edge Construction: Model 2, Seamless.
e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
f. Core: Polyisocyanurate.

1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./BTU when tested according to ASTM C1363.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
b. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.3 MANUAL INTEGRAL HORIZONTAL BLIND LITES:

1. Provide manufactures mircoblinds and accessories at doors indicated on Door Schedule (Doors B116A).

a. Basis-of-Design Product: Subject to compliance with requirements, provide Pariluse LLC; IE Blinds or comparable product by one of the following:

1) ODL
2) Thermat-Tru Corp.
3) Unicel Architectural

b. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Glazed integral blind units to be sealed at perimeter.
3. Integral blind units to be assembled and integrated with tempered, laminated, and Low-E glazing as specified in Section 08800 “Glazing.”
4. Controls: Single side direct drive.
5. Color: to be selected by Architect from manufacturers full range.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot dip galvanized according to ASTM A153/A153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M.

H. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Fire Door Cores: As required to provide fire-protection ratings indicated.
2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.

5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
2. Provide loose stops and moldings on inside of hollow-metal work.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - ECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 08 80 00 - "Glazing" for glass view panels in flush wood doors.
2. Section 08 71 00 - “Door Hardware” for door hardware in/on flush wood doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

    a. Provide Samples for each species of veneer and solid lumber required.
    b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 17 and 50 percent during remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eggers Industries
2. Graham Wood Doors; ASSA ABLOY Group company.
3. Marshfield Door Systems, Inc; Wood Veneered Doors.
4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Source Limitations: Obtain flush wood doors and wood paneling from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

B. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2 or, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

    a. 5-inch top-rail blocking, in doors indicated to have closers.
    b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
    c. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

C. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:

    a. 5-inch top-rail blocking.
    b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
    c. 5-inch midrail blocking, in doors indicated to have armor plates.
    d. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

    a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom (Grade A faces).
2. Species: Select white maple.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.

5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
8. Core: Particleboard.
9. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
10. Construction: Seven plies, either bonded or nonbonded construction.

2.4 MANUAL INTEGRAL HORIZONTAL BLIND LITES:

1. Provide manufactures mircoblinds and accessories at doors indicated on Door Schedule (Doors 116B and C135).
   a. Basis-of-Design Product: Subject to compliance with requirements, provide Pariluse LLC; IE Blinds or comparable product by one of the following:

      1) ODL
      2) Thermat-Tru Corp.
      3) Unicel Architectural
      4) Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Glazed integral blind units to be sealed at perimeter.
3. Integral blind units to be assembled and integrated with tempered, laminated, and Low-E glazing as specified in Section 08800 “Glazing.”
4. Controls: Single side direct drive.
5. Color: to be selected by Architect from manufacturers full range.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

   1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

   1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

2.6 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099123" Interior Painting."

2.7 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Use only paints and coatings that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Transparent Finish:

1. Grade: Custom.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 10, UV curable, water based.
3. Staining: None required.
4. Effect: Open-grain finish.
5. Sheen: Satin.
6. **All finish products shall be “0 (Zero) Lead”, utilizing the lead safe work practices identified in the EPA Guidance Document titled “Steps to Lead Safe Renovation, Repair and Painting”, pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore seal finish before installation on surfaces if fitting, cutting or machining is required either at shop or at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel Access doors and frames for walls and ceilings.

2. Stainless Steel Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

B. Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling.
3. Door Size: 16 inches x 16 inches or as indicated on Drawings.
4. Steel Sheet for Door: Nominal 0.064-inch, 16 gauge.
   a. Finish: Factory finish.
5. Stainless Steel Sheet for Door: Nominal 0.064-inch, 16 gauge.
   a. Stainless Steel Access Doors only required at Kitchen B116 and at all Toilet Rooms throughout project. See exception below for ceilings in toilet rooms.
   b. Finish: No 04.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Lock.

C. Flush Access Doors with Concealed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size. Flange to be taped & textured to be concealed.
2. Locations:
   a. Gypsum Board Wall and ceiling – Classrooms, Corridors & Public Areas.
   b. Ceilings - Toilets A114T, B107T, B118T, C142T & C242T.
3. Door Size: 16 inches x 16 inches or as indicated on Drawings.
4. Steel Sheet for Door: Nominal 0.064-inch, 16 gauge.
   a. Finish: Factory primed finish. Paint to match ceiling/wall.
5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Lock.

D. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling.
3. Fire-Resistance Rating: Not less than 1 hour.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.040-inch, 20 gauge.

   a. Finish: Factory finish.

5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Lock.

E. Hardware:

1. Lock: Cylinder.

   a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 08 71 00 "Door Hardware."

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. Provide mounting holes in frames for attachment of units to metal framing.
2. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.:

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

E. Stainless Steel Finishes:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
      a. Run grain of directional finishes with long dimension of each piece.
      b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.4 Cleaning

A. Remove all visible factory labels.

B. Clean all fingerprints prior to Substantial Completion.

END OF SECTION 08 31 13

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for punched openings.

B. Related Requirements:

1. Section 07 92 00 - “Joint Sealants”.
2. Sections 08 14 16 - “Flush Wood Doors” for doors in Aluminum-Framed Storefronts.
3. Section 08 71 00 - "Door Hardware" for door hardware for doors in Aluminum-Framed Storefronts.
4. Section 08 80 00 - “Glazing” for glazing installed in Aluminum-Framed Storefronts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Required Preinstallation Conference attendees:
      a. General Contractor
      b. Storefront subcontractor
      c. Rigid Insulation Subcontractor
      d. Metal Stud Framing Subcontractor
      e. Gypsum Wallboard Subcontractor
      f. Aluminum Windows Subcontractor
      g. Caulking Subcontractor

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:

      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.

   2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

    a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

D. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

F. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.

G. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.57 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than **35** as determined according to NFRC 500.

H. Noise Reduction: Test according to ASTM E90, with ratings determined by ASTM E1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 34.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
    b. Low Exterior Ambient-Air Temperature: 0 deg F.
    c. Interior Ambient-Air Temperature: 75 deg F.

2.2 EXTERIOR FRAMING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, an Arconic company; Trifab 601 T Framing System, or comparable product by one of the following:

1. EFCO Corporation.
2. U.S. Aluminum; a brand of C.R. Laurence.
3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: Class I, Clear Anodic Finish.
5. Fabrication Method: Field-fabricated stick system.

D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

F. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

    a. Sheet and Plate: ASTM B 209.
    b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
    c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
    d. Structural Profiles: ASTM B 308/B 308M.
    e. Location: As Indicated on Drawings.

2.3 INTERIOR FRAMING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, an Arconic company; Trifab VersaGlaze 451 Framing System, or comparable product by one of the following:

1. EFCO Corporation.
2. U.S. Aluminum; a brand of C.R. Laurence.
3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Non-thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: Class I, Clear Anodic Finish.
5. Fabrication Method: Field-fabricated stick system.

D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

F. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B 209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.
e. Location: As Indicated on Drawings.

2.4 GLAZING

A. Glazing: Comply with Section 08 80 00 - "Glazing":

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.5 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Storefront Framing: Fabricate components for assembly using shear-block system.

G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

A. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 - "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 08 80 00 - "Glazing."

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 08 41 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

B. Related Sections:

1. Section 08 14 16 - "Flush Wood Doors" for installation of door hardware in flush wood doors.
2. Section 08 31 13 - "Access Doors and Frames" for access door hardware, except cylinders.
3. Section 08 41 13 - "Aluminum-Framed Entrances and Storefronts" for installation of entrance door hardware, except cylinders.

1.3 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's representative.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

a. Details of interface of electrified door hardware and building safety and security systems.
b. Schematic diagram of systems that interface with electrified door hardware.

c. Point-to-point wiring.
d. Risers.
e. Elevations: doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.

D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication, and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
d. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
5) Fastenings and other pertinent information.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) List of related door devices specified in other Sections for each door and frame.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

B. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware schedule.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Educational Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

E. Keying Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.9 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:
a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.2 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.3 CONTINUOUS HINGES

A. Continuous Hinges: ANSI/BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

a. Allegion plc.
b. Hager Companies.
c. Pemko Manufacturing Co.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Backset: 2-3/4 inches, unless otherwise indicated.

C. Lock Trim:

1. Levers: Cast.

a. Marks USA; 195.

2. Escutcheons (Roses): Cast.
3. Dummy Trim: Match lever lock trim and escutcheons.
4. Operating Device: Lever with escutcheons (roses).

D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
3. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

E. Bored Locks: ANBSI/BHMA A156.2; Grade 1; Series 4000.

2.5 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Von Duprin; an Ingersoll-Rand company (VON).

2.6 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Contractor shall provide temporary construction cylinders and keying. Contract shall provide final cylinders and keying to work within WCSD Medeco keying system.

a. Exterior Doors: Provide temporary full size IC cylinders that can easily be replaced with full size IC Medeco cylinders.
b. Interior Doors: Provide temporary standard cylinders that can easily be replaced with standard Medeco cylinders.

B. Permanent Cores: Permanent Medeco key cylinders and keying will be provided and installed by Contractor.

2.7 KEYING

A. Keying System: All final and permanent Medeco key cylinders and keying will be provided and installed by Contractor.

B. Provide 25 blank keys to be cut by the Contractor. The Owner shall provide a keying schedule.

2.8 OPERATING TRIM

A. Operating Trim: ANSI/BHMA A156.6; stainless steel, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

    a. Allegion plc.
    b. Don-Jo Mfg., Inc.
    c. Trimco.

2.9 SURFACE CLOSERS

A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. LCN; an Allegion plc brand (LCN).

2. Surface closers shall be installed on the Room-side of the doors.

2.10 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

B. Floor-Mounted Stops: Basis of Design: Ives FS 436

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. Don-Jo Mfg., Inc.
    c. Trimco.
    d. Ives

C. Wall-Mounted Stops: Basis of Design: Ives WS402CCV

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. Don-Jo Mfg., Inc.
    c. Trimco.
    d. Ives

2.11 DOOR GASKETING

A. Door Gasketing: ANSI/BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with

resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

    a. Pemko Manufacturing Co.
    b. National Guard Products, Inc.

2.12 THRESHOLDS

A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

    a. Pemko Manufacturing Co.

2.13 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

    a. Allegion plc.
    b. Don-Jo Mfg., Inc.
    c. Trimco.

2.14 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products as scheduled or available manufacturers offering products that may be incorporated into the Work include the following:

    a. Allegion plc.
    b. Don-Jo Mfg., Inc.
    c. Trimco.
    d. Architectural Openings, PO Box 8047, Colorado Springs, Co 80907, www.IndicatorDeadbolt.com
        1) Restroom Deadbolt Indicator (RDI)
        2) Provide spacers with extended screws at deadbolt indicators.

2.15 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.
2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.16 FINISHES

A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in

the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
3. Fasters shall be supplied which provide adequate anchorage to the specific hardware.
4. Where the substrate will not allow adequate anchorage, appropriate through-bolts shall be used.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Closers: Mount Closers with on **non-public**, interior side of door. Contact architect for clarification. All push-side mounts to be parallel arm.
   1. Use Sex Bolts on all Wood and FRP Doors
   2. Provide Backing Plate on all Hollow Metal Doors

E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 - "Joint Sealants."

F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

H. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Contractor shall remove ALL construction door stops from the jobsite before the project can be considered Substantially Complete.

D. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

Door Hardware Set No. 01 - Classroom Intruder

Qty.	Item	Description	Manufacturer	Finish

1	Cont. Hinge	112HD	Ives	US28
1	Lockset	195DB/G3	Marks	26D
2	Cylinder	20200V0(S) K 26 9C S	Medeco	US26D
1	Closer	4040XP Rw/PA	LCN	AL-689
1	Wall Bumper	WS402CCV	Ives	US26D
1	Perimeter Gasket	By Storefront Manuf.		

Door Hardware Set No. 01A – Exterior Classroom Intruder

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Lockset	195DB/G3	Marks	26D
2	Cylinder	20200V0(S) K 26 9C S	Medeco	US26D
2	Closer	4040XP Rw/PA	Ives	AL-689
1	Coat Hook	B-983 Door Mount	Bobrick	304 Satin
1	Wall Bumper	WS402CV or 1CV (as req.)	Ives	US26D
1	Weatherstrip	316 APK	Pemko	A
1	Threshold	2748	Pemko	A

Door Hardware Set No. 02 – (Student Toilet Room Doors -Accessible)

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1**	Deadbolt	B660P with RDI occupancy indicator (mount at lever height)	Schlage	626
1**	Deadbolt	B661P	Schlage	626
2	Door Pulls	8103-2 x Type J/N Mount Mount vertical on each side	Ives	626
1	Closer	4040XP Rw/PA	LCN	Al-689
1	Coat Hook	B-983 Door Mount	Bobrick	304 Satin
1	Wall Bumper	WS402CV or 1CV (as req.)	Ives	US26D
1	Adj. Door Bottom	SL-301	Special-Lite	
1	Perimeter Gasket	By Storefront Manuf.		

** **MEDECO S4 CYLINDER**

Door Hardware Set No. 03 – Conference Room

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Lockset	195AB/G3	Marks	26D
1	Cylinder	20200V1(S) K 26 9C S	Medeco	US26D
1	Wall Bumper	WS402CVX	Ives	US26D
1	Perimeter Gasket	By Storefront Manuf.		

Door Hardware Set No. 04 – Interior Storeroom @ Aluminum Frame

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Lockset	195F/G3	Marks	26D
1	Cylinder	20200V1(S) K 26 9C S	Medeco	US26D
1	Closer	4040XP Rw/PA	LCN	AL-689
1	Wall Bumper	WS402CV or 1CV (as req.)	Ives	US26D
1	Kickdown Holder	FS452-4	Ives	US26D

Door Hardware Set No. 05 – Exterior Exit HM without Access Control

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Exit Device	LD 99NL-OP-F	Von Duprin	US26D
1	Cylinder	33-07603V	Medeco	US26D
1	Closer	4040XP-3077CNS	LCN	AL-689
1	Door Bottom Sweep	18061NB	Pemko	C
1	Perimeter Gasket	By Storefront Manufactuer		
1	Door Pull	990NL Trim Plate	Von Duprin	US26D
1	Exterior Trim Plate	OEO	Von Duprin	US26D

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Glass for storefront framing.
2. Glazing sealants and accessories.

B. Related Requirements:

1. Section 08 14 16 - “Flush Wood Doors” for glazing in flush wood doors.
2. Section 08 11 13 – “Hollow Metal Doors and Frames” for glazing in hollow metal doors.
3. Section 08 41 13 - "Aluminum Framed Entrances and Storefronts."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products: 12 inches square.

1. Laminated glass.
2. Insulating glass.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Preconstruction adhesion and compatibility test report.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

A. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 08 41 13 - "Aluminum-Framed Entrances and Storefronts" and Section 08 51 13 - "Aluminum Windows" to match glazing systems required for Project, including glazing methods.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Glazing Film: Follow International Window Film Association (IWFA) guidelines for Architectural Visual Inspection Standard for Applied Window Film.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:

1. Guardian Glass; SunGuard.
2. Oldcastle Building Envelope™.
3. Viracon, Inc.
4. Citadel Architectural Products, Inc.
5. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

1. Obtain tinted glass from single source from single manufacturer.
2. Obtain reflective-coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E1300.

1. Design Wind Pressures: As indicated on Drawings.

2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE 7-16, based on heights above grade indicated on Drawings.

    a. Wind Design Data: As indicated on Drawings.
    b. Basic Wind Speed: 130 mph (Ultimate).
    c. Risk Category: III.
    d. Exposure Category: C.
    e. Ground Elevation Factor, K_e: 1.0

3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic glass lites, properties are based on units with lites 6 mm thick.
2. For laminated glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.
7. Optical Distortion Limits:
    a. Maximum peak-to-valley roll wave 0.005 inch in the central area of the glass lite excluding the leading and trailing 12 inches.
    b. Maximum localized and overall bow (warp) per lite shall each be one-half of maximum allowed by ASTM C1048.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units (G1): Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Aluminum with black, color anodic finish.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 EXTERIOR INSULATING OPAQUE COMPOSITE PANELS – G2

A. Water Resistant Opaque Glazing Panels

1. Manufacturer: Citadel Architectural Products, Inc., or equal.
2. Prefinished Smooth Aluminum Skins .024” (min).
3. High Density Polypropylene Stabilizers 5/32”
4. Polyisocyanurate Foam ISO Core 5/8”
5. Panel Weight: 1.05 lbs/s.f.
6. Nominal Thickness: 1”
7. Exterior Aluminum Skin Finish: Class 1 Clear Anodized
8. Interior Finish: Standard- Plus Kynar 500 or Premium Kynar 500

a. Color: As selected by Architect from Manufacturer’s full range.

2.7 MANUAL INTEGRAL HORIZONTAL BLIND LITES AT DOORS: (Doors B19, D2)

1. Provide manufactures microblinds and accessories at doors indicated on Door Schedule.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Pariluse LLC; IE Blinds or comparable product by one of the following:

        1) ODL
        2) Thermat-Tru Corp.
        3) Unicel Architectural
2. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.
3. Glazed integral blind units to be sealed at perimeter.
4. Integral blind units to be assembled and integrated with tempered and laminated glazing.
5. Controls: Single side direct drive.
6. Color: to be selected by Architect from manufacturers full range.

2.8 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Field-applied sealants shall have a VOC content of not more than 250 g/L.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Corning Corporation; Dow Corning® 790 Silicone Building Sealant.
    b. Pecora Corporation; 890NST.
    c. Sika Corporation; SikaSil WS-290.
    d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers:
   1. Types recommended by sealant or gasket manufacturer.
   2. Types recommended by PVC film manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. PVC Film: Examine glass surfaces to receive film and confirm surfaces are ready to accept the film application.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

C. Clean glazing receiving PVC film following manufacturer's recommendations.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior, or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

E. Protect glazing films from damage until the Work has been accepted by the Owner.

3.6 MONOLITHIC GLASS SCHEDULE

A. Glass Type – **G1**: Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

3.7 MANUAL INTEGRAL HORIZONTAL BLIND LITES AT DOORS – see Specification Sections 08 11 13 Hollow Metal Doors and Frames, 08 14 16 – “Flush Wood Doors”.

END OF SECTION 08 80 00

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. Section 05 40 00 - "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For firestop tracks; submit evaluation reports certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 accreditation criteria for inspection agencies, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or similar organization providing a verifiable code-compliance program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Design framing systems in accordance with AISI S220, unless otherwise indicated

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated.
2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40 (Z120), hot-dip galvanized, or coating with equivalent corrosion resistance, unless otherwise indicated. Galvannealed products are unacceptable.
    a. Coating to demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Studs and Track: AISI S220. Use either steel studs and tracks or steel studs and tracks of equivalent minimum base-steel thickness.

1. Steel Studs and Track:

    a. Minimum Base-Steel Thickness: As indicated on Drawings.
    b. Depth: As indicated on Drawings.

2. High-Strength Steel Studs and Track:

    a. Minimum Base-Steel Thickness: As indicated on Drawings.
    b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Track System: Top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Track System: Top track, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction fit inside inner track.
3. Slotted Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Backing Plate: Proprietary fire-retardant-treated wood blocking and bracing in width indicated.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: As indicated on Drawings.

G. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: AISI S220.

1. Minimum Base-Steel Thickness: As indicated on Drawings.
2. Depth: As indicated on Drawings.

I. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.053 inch and minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch base-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Track: AISI S220.
   a. Minimum Base-Steel Thickness: As indicated on Drawings.
   b. Depth: As indicated on Drawings.
3. Hat-Shaped, Rigid Furring Channels: AISI S220, 7/8 inch deep.
   a. Minimum Base-Steel Thickness: As indicated on Drawings.
4. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
   a. Configuration: Asymmetrical or hat shaped.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
   a. L-Shaped Clips as required to support metal framing from masonry thru rigid insulation.
   b. Other miscellaneous clips as required.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance- rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. Gypsum Association document GA-216- Current Edition, *Application and Finishing of Gypsum Board.*

B. ASTM C 840, *Standard Specification for Application and Finishing of Gypsum Board*

1.3 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Fiber-reinforced cementitious backer board.

B. Related Requirements:

1. Section 06 16 00 - "Sheathing" for gypsum sheathing for exterior walls.
2. Section 07 92 00 - "Joint Sealants".
3. Section 09 22 16 - "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
4. Section 09 91 23 - "Interior Painting" for painting of gypsum board surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTME 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Georgia-Pacific
2. National Gypsum Company
3. USG Corporation

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Acoustic Gypsum Board:

1. Basis of Design: Subject to compliance with project requirements, the design is based on the following: "Certainteed Brand SilentFX Type X" noise-reducing gypsum board.
2. Abuse Resistance Characteristics:
   a. Abrasion Resistance; Level 2
   b. Soft Body Impact Resistance; Level 1
3. Meet or exceed ASTM C1766 and applicable sections of C1396.
4. ASTM E84 Surface-Burning Characteristics:
   a. Flame Spread: 15
   b. Smoke Developed: 0
5. ASTM C473, the average water absorption for panels is not greater than 5% by weight after two-hour immersion.
   a. Core Hardness: Not less than 11
   b. Flexural Strength (lbf):
      1) Parallel: Not less than 46
      2) Perpendicular: Not less than 147
   c. Nail Pull Resistance (lbf): Not less than 87.
6. Thickness: 5/8 inch (12.7 mm)
7. Length: 8'-0" (2440 mm).
8. Width: 4'-0" (1220 mm)
9. Minimum Weight: 2.8 lbs./ft^2 (13.6 mm)
10. Long Edges: Tapered.
11. Provides a minimum STC 58 rating for UL Design V450 or V486.

2.4 CEMENTITIOUS BACKER BOARD

A. Fiber-Cement Backer Board: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: 5/8 inch.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet**; vinyl, PVC-based composite;** or rolled zinc.
2. Shapes:
   a. Cornerbead - provide at all outside corners, typical.
   b. LC-Bead: J-shaped; - provide as shown on the drawings, exposed long flange receives joint compound.
   c. L-Bead: L-shaped; - provide at all gypsum board ends butted to other material, typical, long flange receives joint compound.
      1) Contractor may utilize Trim-Tex PVC Tear Away L Bead, or equal, at his option.
3. Gypsum Board Reveal Trim at STEAM Lab B101 and Toilet Rooms Resinous Wainscot transition to be Fry Reglet DCS-625-75 Aluminum or equal. Provide Fry Reglet end caps at the open end of each segment.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C1002, unless otherwise indicated.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

1. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated.
2. Type X: Vertical surfaces unless otherwise indicated.
3. Abuse-Resistant Type: As indicated on Drawings.
4. Moisture- and Mold-Resistant Type: As indicated on Drawings.
5. Install gypsum panel products applied to walls with the bottom edge spaced a minimum of ¼" above the floor
    a. At floor conditions where gypsum board walls abut or return to door or window frames, the gypsum panels shall extend to the floor. See typical architectural details.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
3. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim: Install in the following locations:
1. Cornerbead - provide at all outside corners, typical.
2. LC-Bead: J-shaped; - provide as shown on the drawings, exposed long flange receives joint compound.
3. L-Bead: L-shaped; - provide at all gypsum board ends butted to other material, typical, long flange receives joint compound.
   a. Contractor may utilize Trim-Tex PVC Tear Away L Bead, or equal, at his option.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C
840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 3 with Spatter or Heavy Orange Peel texture: At panel surfaces that will be exposed to view in service areas (Mechanical, electrical, telecommunications rooms, storage rooms, etc.) unless otherwise indicated.
3. Level 4 with Light Orange Peel texture: At panel surfaces that will be exposed to view which are accessible to the public (Kitchens, classrooms, corridors, stairs, administration areas, offices, workrooms, toilet rooms, etc.) unless otherwise indicated.
4. Primer and its application to surfaces are specified in Section 09 91 23 - "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 35 43 - POLISHED CONCRETE FINISH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Products and procedures for coloring and bonded abrasive polishing concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.

1.3 DEFINITIONS

A. Terminology: As defined by the Concrete Polishing Council (CPC), a specialty council of the American Society of Concrete Contractors.

B. Polished Concrete: The act of changing a concrete floor surface, with or without aggregate exposure, to achieve a specified level of gloss.

C. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, polishing of a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of finished gloss as defined by the CPC. This yields the most durable finish and requires the least amount of maintenance.

1.4 STANDARDS

A. ASTM 5767 - Standard Test Method for Instrumental Measurement of Distinctness- of-Image Gloss of Coating Surfaces

B. ASTM D523 – Standard Test Method for Specular Gloss

C. ANSI A326.3-2017 (Dynamic Coefficient Friction of Hard Surface Flooring)

D. DIN EN ISO 4287 - Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters.

E. CSDA-ST-115 - Measuring Concrete Micro Surface Texture.

F. Other references:

1. CPC Appearance Chart and Aggregate Exposure Chart for polished concrete, as defined by the Concrete Polishing Council (CPC), a specialty council of the American Society of Concrete Contractors (ASCC)

1.5 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.

B. Samples for Initial Selection: For each type of product requiring color selection.

C. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 "Quality Assurance" Article.

B. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Applicator/Polisher Qualifications:

1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work. Minimum 2 years documented experience in work of this Section.
2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress.
3. Manufacturer Qualification: Requires letter of recommendation from polishing system manufacturer. Approved by manufacturer to apply liquid applied products.

B. Mockups: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing.

1. Size: Minimum 100 square feet for each color and finish at location adjacent to floor that will receive polish, but will be covered with another flooring material.
2. Show requested polished finish.
3. Test aggregate to ensure it will accept polish.

4. Include control joints and edges.
5. Approved mockups may not remain as part of the Work.
6. Mockup to meet or exceed Gloss Rating, DOI and RA requirements
7. Minimum Gloss Rating (GU) of 30 at 60 degrees.
8. Minimum DOI of 30 after the application of Concrete Hardener prior to application of Sealer
9. Maximum RA of 40 micro inches or less.
10. Obtain Architect's approval before starting work on Project.

C. Coefficient of Friction: Minimum 0.43, tested to ANSI/NFSI B101.3 after polishing.

C. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:
   a. Owner.
   b. Architect.
   c. Contractor, including supervisor.
   d. Concrete producer.
   e. Concrete finisher, including supervisor.
   f. Concrete polisher, including supervisor.
   g. Technical representative of liquid applied product manufacturers.
2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
   a. Tour field mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
   b. Review Contract Document requirements.
   c. Review approved submittals and field mock-up.
   d. Review procedures, including, but not limited to:

      1) Applicable Division 03 Section on cast-in-place concrete
         a) Specific mix design.
         b) Specified curing methods/procedures.
         c) Projected 3-, 10-, and 28-day compression strength test related to specified aggregates exposure for finished floor and project phasing.
         d) Protection of concrete substrate during construction and prior to polishing process.

      2) Project phasing and scheduling for each step of grinding, honing and polishing operations including, but not limited to:
         a) Quality of qualified personnel committed to project.
         b) Quality and size of grinders committed to project.
         c) Proper disposal of concrete slurry and/or concrete dust.

      3) Details of each step of grinding, honing, and polishing operations.
         b) Application of liquid applied products (Densifier).
         c) Protecting polished concrete floors after polishing work is complete.

D. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.7 FIELD CONDITIONS

A. Protect concrete surfaces scheduled to receive polished finish after concrete placement but prior to polishing; prevent damage and staining:
   1. Prohibit vehicular traffic on surfaces to be polished.
   2. All equipment must be equipped with non-marking tires.
   3. Diaper all hydraulic equipment.
   4. Prohibit pipe cutting operations on surfaces to be polished.
   5. Prohibit storage on surfaces to be polished for minimum 28 days after concrete placement.
   6. Prohibit ferrous metals storage on surfaces to be polished.
   7. Prevent liquid drippings from equipment on surfaces to be polished.
   8. Prevent acids and acidic detergents from contacting surfaces to be polished.
   9. Prevent painting over surfaces to be polished.

B. Comply with chemical manufacturer's requirement for ambient and surface temperature and humidity ranges before, during, and after application.

C. Close areas to traffic during finishing and for minimum time period after finishing as recommended by chemical manufacturer.

D. Concrete: Cured minimum 28 days or to which point where equipment can operate on slab without displacing aggregate.

1.8 SCHEDULING

A. Schedule polishing minimum 21 days prior to fixture and trim installation

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original containers, with seal's unbroken, bearing manufacturer labels indicating brand name and directions for storage.

B. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers.

C. Store materials in a clean, dry area in accordance with manufacturer's instructions.

D. Keep products from freezing.

1.10 PROJECT CONDITIONS

A. Environmental limitations:

1. Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.

    a. Specified overall values of flatness, F(F) 50: and of levelness, F(L) 30; with minimum local values of flatness F(F) 35; and of levelness, F(L) 20.
    b. Concrete must be cured a minimum of 45 days or as directed by the manufacturer before application of special floor finish hardening/sealing agent can begin.
    c. Application of special floor finish hardening/sealing agent shall take place 10 days prior to installation of equipment and substantial completion, thus providing a complete, uninhibited concrete slab for application.

2. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Husqvarna SUPERFLOOR Concrete Polishing Systems.
Contact: Ryan Atkinson; Architectural Specifier, Mobile: (470) 612-9010,
ryan.atkinson@husqvarnagroup.com

B. Ensure Concrete finishing compounds and repair materials are from a single source manufacture for Proprietary Products/Systems.

2.2 MATERIALS

A. Concrete Dye: No Dye or Stains to be included.

B. Concrete Hardener
1. Type: Neutral pH, Colorless, penetrating produced specifically for sealing and hardening concrete surfaces
2. Product: Husqvarna SUPERFLOOR Treatments including CURE Densifier & Hardener
3. Maximum volatile organic compound (VOC) content: <50 grams per liter

C. Topical Sealer:
1. Type: Milky white, penetrating product produced specifically for creating a hydrophobic and high stain resistance finish for stained or polished concrete surfaces.
2. Product: Husqvarna SUPERFLOOR Treatments including PREMIUM GUARD
3. Maximum volatile organic compound (VOC) content: <50 grams per liter.

D. Hydrophobic Sealer (at Multi-purpose Room):
1. Type: Milky white, semi-penetrating product produced specifically for creating a topical hydrophobic and high stain resistance finish for stained or polished concrete surfaces.
2. Product: Husqvarna SUPERFLOOR Treatments including TOPICAL GUARD
3. Maximum volatile organic compound (VOC) content: <50 grams per liter.

E. Repair Materials:

1. Small gouges in concrete should be repaired with Polyurea, Color: Clear, prior to polish process.

2. Patching Material:

   a. Basis of Design Source: HI-TECH Systems, Ontario, CA, (800) 454-5530, www.hitechpolyurea.com.
   b. Product: HTS Chemical PE-85, Color: clear
   c. Maximum volatile organic compound (VOC) content: <50 grams per liter.

F. Grout Material
   a. Basis of Design Source: Husqvarna SUPERFLOOR Treatments. Olathe, KS, (800) 288-5040, www.husqvarnaconstruction.com
   b. Type: Acrylic grout material.
   c. Product: Husqvarna GM 3000
   d. Maximum volatile organic compound (VOC) content: <50 grams per liter.
   e. For repairs/grout coat. Apply over entire polished floor.

G. Diamond tools required for Heavy Aggregate, Class C Finish:
   a. Metal bonded; 20 Grit Gold, 50 Grit Brown.
   b. Resin bonded: 50 semi-metal (Brown), 100 resin (Black), 200 resin (Blue), 400 resin (Red).

H. Grinding Pads for Edges:
   a. Use necessary steps to remove trowel marks, discoloration and other flaws near wall lines. Some irregularities may remain, but should be brought to the attention of owner architect for review if question of consistency or desired finish.

I. Joint Fill Material
   1. Basis of Design Source: HI-TECH Systems, Ontario, CA, (800) 454-5530, www.hitechpolyurea.com.
   2. Type: Fast setting chemical resistant Polyurea.
   3. Product: HTS Chemical PE-85, Color: Clear
   4. Maximum volatile organic compound (VOC) content: <55 grams per liter.

2.3 ACCESSORIES

A. Cleaning Products: Non-corrosive, neutral pH. Husqvarna SUPERFLOOR Treatments including CLEAN & PROTECT recommended to clean and maintain for after care.

2.4 EQUIPMENT

A. Polishing Equipment:
   1. Three or four head dual-drive, counter-rotating, or planetary variable speed approved floor grinder with minimum 600 pounds down pressure.
   2. Hand grinder with dust extraction attachment and pads.

B. Vacuum Equipment:
   1. Approved dust extraction system, pre-separator, and squeegee attachments to comply with OSHA Crystalline Silica Standard for Construction under 29 CFR 1926.1153

C. Auto Scrubber with soft disk style brushes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine concrete substrates for conditions affecting performance of finish.

B. Repairs not acceptable unless approved by Architect or General Contractor.

C. Verify that concrete substrate meets finish and surface profile requirements.

D. Ensure that concrete is sufficiently cured to accept polishing.

3.2 PREPARATION

A. Testing Concrete Floors:
   1. Alkalinity:
      a. Test method: Measure pH according to ASTM F710.
      b. Acceptable results: pH above 9.
   2. Moisture Vapor Transmission:
      a. Test method: Perform anhydrous calcium chloride test to ASTM F1869.
      b. Acceptable results: Maximum 5 pounds per 1000 square feet in 24 hours.
   3. Relative humidity:
      a. Test method: Perform relative humidity test using in situ probes to ASTM F2170.
      b. Acceptable results: Maximum 75 percent.
   4. Surface Texture
      a. Calibrate Profilometer and record surface texture per CSDA ST118.

B. Clean surfaces of loose and foreign materials and debris.

C. Protect adjacent surfaces from damage.

3.3 POLISHING

A. Initial Grinding:

1. Identify high spots or areas in concrete, wall edges, etc. that may require additional grinding where aggregate may be exposed.
2. Select appropriate tool and process to achieve desired results.
3. Remove construction debris and floor slab imperfections until uniform scratch pattern and desired concrete aggregate exposure is achieved using appropriate tools, and manufactures instruction.
4. Achieve maximum refinement as per ST 115 or polishing system manufacturer before proceeding to next tool.
5. Clean floor using auto scrubber vacuum with brushes after each pass.

B. Treating Surface Imperfections:

1. Mix patching compound and grout material by using HTS Chemical “Spall TX3” or equal, to match color of adjacent concrete surface.

2. Fill surface imperfections prior to polishing. If surface residues exist, expose repair areas by a removal pass over floor first.

3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

C. Surface Grouting: Apply Husqvarna GM 3000 to entire floor for a cementitious grout coat onto surface to fill voids, to [match] color of concrete using grout pans on machine to work material into the pours. Allow to cure minimum of 6 hours to overnight.

D. Honing:
1. Grind surfaces to within 2 - 3 inches of walls with semi metal and resin bonded diamond pads of 100, 200 grit, grinding 90 degrees from each previous grind.
2. Grind edges with appropriate tool per ST115 and tools capacity.
3. Remove scratches and achieve maximum refinement with each pass before proceeding to finer grit pads.
4. Vacuum floor using squeegee vacuum attachment after each pass.

E. Polishing:
1. Apply undiluted Husqvarna SUPERFLOOR CURE densifier/hardener at rate of 400 to 600 square feet per gallon.
   a. Allow to stand on surface for 10 minutes, then reapply to areas where densifier/hardener has soaked in and allow to stand for an additional 20 minutes.
   b. Allow material to dry.
   c. Do not remove excess densifier/hardener from floor.
2. Use polishing equipment with resin bonded polishing and burnishing pads.
3. Begin polishing in one direction starting with appropriate tool as required to achieve specified surface finish.
4. Polish edges first, then field of floor.
5. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass.
6. Achieve maximum refinement with each pass before proceeding to finer grit pads.
7. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
8. Continue polishing until gloss appearance, as measured according to ASTM E430, matches approved mockup.

3.4 SEALING

A. Apply sealer to manufacturer’s recommend coverage, roughly 1,000 square feet fer gallon.

B. Remove excessive sealer.

C. Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen

matching approved mockup.

3.5 PROTECTION

A. Close areas to traffic until concrete treatment has cured.

B. Protect completed work with non-staining sheet coverings until just prior to Substantial Completion.

3.6 CONCRETE POLISHING SCHEDULE

A. Sheen:
1. CPC Level 2
2. Satin/Honed, DOI greater than 30, Gloss Units (GU) greater than 30, RA less than 40.

B. Aggregate Exposure:
1. CPC Heavy Aggregate Class C

C. OVERALL FLOOR DESIGN
1. CPC C2



END OF SECTION 09 35 43

SECTION 09 51 23 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Acoustical panels for ceilings.
   2. Suspension systems.

B. Related Requirements:

   1. Section 23 37 00 - “Air Outlets and Inlets” for HVAC registers in acoustical panel ceilings.
   2. Section 26 51 00 - “Interior Lighting” for light fixtures in acoustical panel ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6-inches- in size.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: 12 Full-size panels.

1.6 QUALITY ASSURANCE

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they

will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS TYPE 1

A. Available Manufacturers: Subject to compliance with requirements, available manufacturers include, but are not limited to, the following:
   1. Armstrong World Industries, Inc. – Mesa 683
   2. USG Interiors, Inc.
   3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Classification: Provide panels complying with ASTM E1264 for type, form, and pattern as follows:
   1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
   2. Pattern: CE (perforated, small holes and medium texture).
   3. Color: White.
   4. Edge/Joint Detail: Square
   5. Thickness: 3/4 inch.
   6. Size: 24 inches by 48 inches.
   7. NRC: 0.60
   8. CAC: 33
   9. Class A
   10. Light Reflectance: 0.85

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C635/C635M.

B. Attachment Devices: Size five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.135-inch- diameter wire.

D. Seismic Struts: Manufacturer’s +standard compression struts designed to accommodate lateral forces.

E. Seismic Clips: Manufacturer’s standard seismic clips designed and spaced to secure acoustical panels in-place.

2.5 METAL SUSPENSION SYSTEM

A. Products: Subject to compliance with requirements, available products include, but are not limited to, the following:
   1. Armstrong World Industries, Inc. – Standard Prelude 15/16”
   2. USG Interiors, Inc.; - Donn DXW 15/16”
   3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A653/A653M, G30 coating designation.
   1. Structural Classification: Intermediate-duty system.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. Provide Shadow Reveal edge moldings where shown on Drawings. Armstrong Shadow Molding 7878 or equal.
   3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 FINISHES

A. All products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 775-851-5675.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL PANEL CEILINGS

A. General: Install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   6. Do not attach hangers to steel deck tabs.
   7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
   9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical panel ceiling area and where necessary to conceal edges of acoustical panels.
   1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
   2. Do not use exposed fasteners, including pop rivets, shall match color on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical panels as follows:
   1. As indicated on reflected ceiling plans.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

Remove and replace panels and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rubber base.
2. Rubber molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE - B1

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
2. Johnsonite; a Tarkett company.
3. Roppe Corporation, USA.
4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

a. Style B, Cove: As indicated on Drawings.

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: 100’ coil.

F. Outside Corners: Field formed

G. Inside Corners: Field formed

H. Colors: As selected by Architect from full range of industry colors.

2.2 RUBBER STAIR ACCESSORIES

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Johnsonite: A Tarkett company
2. Nora Systems, Inc.

3. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

C. Stair Treads: ASTM F2169.

1. Type: TS (rubber, vulcanized thermoset).
2. Class: 2 (pattern; embossed, grooved, or ribbed).
3. Group: 1 (embedded abrasive strips).
4. Nosing Style: Square.
5. Nosing Height: 1-1/2 inches.
6. Thickness: 1/4 inch and tapered to back edge.
7. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
8. Integral Risers: Smooth, flat; in height that fully covers substrate.

D. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 RUBBER MOLDING ACCESSORY

A. Description: Rubber carpet edge for glue-down applications.

B. Profile and Dimensions: As indicated.

C. Locations:
1. At exposed carpet edges that meet Polished Concrete floors.
    a. Johnsonite EG-XX-G Double Undercut or equal.
2. At exposed carpet edges that meet Resinous Flooring.
    a. Johnsonite CTA-XX-D Molding or equal.
3. At exposed rubber tile or rubber stair tread edges that meet Polished Concrete floors.
    a. Johnsonite CD-XX-T Molding or equal.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RUBBER BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply rubber base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install rubber base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere rubber base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch rubber base during installation.

F. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Rubber Stair Accessories:

1. Tightly adhere to substrates throughout length of each piece.
2. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 67 23 - RESINOUS FLOORING & WAINSCOT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Methyl Methacrylate (MMA) acrylic floor coating system.
2. Transition strips between unrelated flooring surfaces (if required)

B. Related Requirements

1. Section 09 65 13 - “Resilient Base and Accessories” for transition strips between resinous flooring and resilient flooring – if required.
2. Section 09 29 00 – “Gypsum Board” for substrates for MMA.

1.3 REFERENCE STANDARDS

A. ACI 308 - Standard Practice for Curing Concrete (if applicable)

B. ACI 302.1R-80 - Guide for Concrete Floor and Slab Construction (if applicable)

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
2. The agenda shall include a review and clarification of this specification, application procedures, quality control, inspection and acceptance criteria, and production schedules.
3. Review details of integral cove bases.
4. Review manufacturer's written instructions for installing resinous flooring systems.
5. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.
6. Applicator is NOT authorized to proceed until this meeting is held or waived by Owner.
7.

1.5 SUBMITTALS

A. Acceptance Sample: One foot square (1 ft. by 1 ft.) sample of the specified acrylic flooring system applied to hardboard or similar backing for rigidity and ease of handling.

B. Manufacturer's Literature: Descriptive data and specific recommendations for surface preparation, mixing, and application of materials.

C. Manufacturer's Material Safety Data Sheets (MSDS) for each respective product to be used.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Must have a minimum of 10 years of experience manufacturing methyl methacrylate systems (MMA).

B. All products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.

C. Applicator Qualifications:
1. Pre-qualification requirements: Each bidder for this project shall be prequalified and approved by the material Manufacturer at the time of bid submittal.
2. Each approved applicator shall have been trained by the Manufacturer in all phases of surface preparation and application of the specified flooring system(s).
3. Each approved applicator must have five (5) years of experience of installing the specified flooring system and submit a list of five (5) projects/references of equal size, quantity, and magnitude to this Project as a prequalification requirement.

D. Acceptance Sample:
1. A minimum one-foot square representative sample of the specified flooring system shall be prepared by the Manufacturer's representative and submitted to the Owner during the submittal process.
2. The installed flooring system shall be similar to the acceptance sample in thicknesses of respective film layers, color, texture, overall appearance and finish.

E. Bond Testing:
1. Surface preparation efforts shall be evaluated by conducting Bond Tests at the site prior to application of the flooring system(s).
2. See paragraph 3.03 - B or consult with Material Manufacturer for specific procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. All material shall be delivered in original Manufacturer's sealed containers with all pertinent labels intact and legible.

B. Store materials in dry protected area between 25° and 80° Fahrenheit. Keep out of direct sunlight. Protect from open flame; keep all containers grounded.

C. Follow all Manufacturer's specific label instructions and prudent safety practices for storage and handling.

1.8 PROJECT CONDITIONS

A. Material, air, and surface temperatures shall be in the range of 25° to 85° Fahrenheit during application and cure, unless a special formulation is being used and Manufacturer has been consulted.

B. Relative humidity in the specific location of the application shall be less than 85 percent and the surface temperature shall be at least 5 degs. above the dew point.

C. Conditions required of new concrete to be coated with MMA materials:
   1. Concrete shall be moisture cured for a minimum of 7 days at 70° F. The concrete must be fully cured for a minimum of 28 days prior to application of the coating system pending moisture testing.
   2. Surface contaminants such as curing agents, membranes, or other bond breakers should not be used.
   3. Concrete shall have a "rubbed" finish; float or darby finish the concrete (a hard steel trowel is neither necessary nor desirable).
   4. Drains should be set to the concrete grade rather than raised to the finished grade of the topping.

D. Concrete shall have a moisture emission rate of no more than 3 lbs. per 1000 sq. ft. per 24-hour period as determined by proper Calcium Chloride Testing or less than 90% RH (relative humidity) when testing with in-Situ Probe testing.

E. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

F. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. The self-leveling Full Flake floor topping system shall be 1/8" thick (color and texture selected by owner), with appropriate Primer and Topcoat.

B. The self-leveling Full Flake topping system shall cure and be available to normal traffic in no more than 60 minutes at 68° F. after application of last coat. The cured material shall have a minimum compressive strength of 6,000 psi in accordance with ASTM C109. It shall have a maximum water absorption value of 0.04 weight percent in accordance with ASTM D570. It shall be chemically resistant to a wide range of acids, alkalis, salts, fats, oils, and other chemicals typically found in K-12 school environments.

C. The finished floor coating system shall be uniform in color, texture, and appearance. All edges that terminate at walls, floor discontinuities, and other embedded items shall be sharp, uniform, and cosmetically acceptable with no thick or ragged edge. The Contractor/Applicator shall work out an acceptable masking technique to ensure the acceptable finish of all edges.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Key MMA Chip 900, Key Resins Company (Basis of Design)
   2. BASF Flooring
   3. SILIKAL
   4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.3 MATERIALS

A. Methyl Methacrylate (MMA) Acrylic Resin System:
   1. Saturating Primer/Sealer Coat: Key MMA 9112
   2. Coving (if required): Key MMA Cove Paste with appropriate filler
   3. Patching/Sloping (if required): Key MMA Polymer Concrete 9510 MMA Resin
   4. Key 9418 Self-Leveling, consisting of MMA resin and decorative vinyl chip broadcast.
   5. Topcoat(s) of clear, UV resistant 9526 MMA finish
   6. Pigment of 9418: Color to compliment Colored Vinyl Flake.
   7. Key Broadcast Vinyl Flake/Chips:
   8. If added skid resistance is required, aluminum oxide or NSA (polycarbonate non-skid additive beads), may be broadcast into the primer or body coat or suspended into finish coat to to achieve specified skid/slip resistance requirements. Mesh size and rate to be determined by Owner based upon recommended amounts described by Mfg. for various COF.

B. Colors: As selected by Architect from manufacturer's full range and/or to match existing color and texture for the desired flooring affect.

2.4 PRODUCT PERFORMANCE CRITERIA

A. Key 9112 Primer/Sealer

1.	Percentage Reactive Resin:	100%
	Percentage Solids	100%
2.	Physical Properties	
a.	Working Life, 50ºF-70ºF	8-10 minutes, will vary with temp. & amount of Hardener
b.	Recoat Time	45-60 minutes
c.	Viscosity	250-270 cps
d.	Weight per Gallon	8.3 lbs.
e.	Bond Strength:	300-400+psi (100% concrete failure)

B. Key Polymer Concrete 9510 MMA Resin

1.	Appearance	Bluish tint, low viscosity
2.	Viscosity @ 75ºF:	140-150 cps
3.	Weight per Gallon:	8.1 lbs.
4.	Percent Reactive:	100%, zero VOC
5.	Pot Life (working time) 73ºF:	20-25 minutes
6.	Tensile Strength (filled mortar):	7,800
7.	Bond Strength	300-400+ psi (100% concrete failure)

C. Key 9418 MMA Binder

1.	Percentage of reactive resin:	100%
	Percentage of solids:	100%
2.	Appearance:	Viscous Liquid

3.	Viscosity, cps @ 73ºF:	280-290 cps
4.	Weight per Gallon:	8.1 lbs.
5.	Working Life, 50ºF-70ºF:	15-30 mins., will vary w/temp. @ amt. of Hardener
6.	Cure Rate:	40-60 minutes
7.	Recoat Time:	60 minutes

D. Key 9526 MMA Sealer/Topcoat Resin

1.	Percentage Reactive Resin:	100%
2.	Percentage Solids:	100%
3.	Working Life, 50ºF-70ºF:	10-25 minutes, will vary w/temp. @ amt. of hardener
4.	Recoat Time:	60-120 minutes
5.	Viscosity @ 75ºF:	380-390 cps
6.	Weight per Gallon:	8.3 lbs.
7.	Heat Resistance, dry heat:	216ºF
8.	Shore D Hardness:	65-70

2.5 PRODUCT INSTALLATION & APPLICATION CRITERIA

A. All Key MMA Material Systems:

1.	Pot Life at 68° F.:	10-15 minutes
2.	Cure Time at 68° F.:	60 minutes
3.	Recoat Time at 68° F.:	60-90 minutes

2.6 MIXES

A. Follow Manufacturer's prescribed procedures and recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all surfaces to be coated with Key MMA material systems and report to the Owner and/or Architect any conditions that will adversely affect the appearance or performance of these coating systems and that cannot be put into acceptable condition by the preparatory work specified in Paragraph 3.03.

B. Do not proceed with application until the surface is acceptable or authorization to proceed is given by the Owner’s Representative.

C. In the event that Applicator has employed all acceptable methods of surface preparation and cannot remedy adverse conditions that would lead to failure of the installation, Applicator shall withdraw from the contract and Owner will be financially responsible only for preparation efforts.

3.2 GENERAL

A. Material storage area must be selected and approved by Applicator and Owner or his representative.

B. If existing ventilation is inadequate, Applicator will provide sufficient ventilation to allow complete air exchange every five (5) minutes.

C. Applicator will protect adjacent surfaces not to be coated with masking and/or covers. Owner's equipment, materials, and existing finishes shall be protected from dust, cleaning solutions, and flooring materials.

3.3 PREPARATION

A. Surface Preparation – General
1. Concrete substrate must be clean and dry. Dislodge dirt, mortar spatter, paint overspray, and other dry surface accumulations and contamination by scraping, brushing, sweeping, vacuuming, and/or compressed air blowdown.
2. New concrete: See 1.7.C for requirements.
3. Surfaces that are heavily contaminated shall be cleaned with the appropriate degreaser, detergent, or other appropriate cleaner/surfactant followed by thoroughly rinsing with fresh water to remove the accumulation prior to mechanical cleaning efforts. Mechanical cleaning will not remove such deposits, but only drive them deeper into the substrate.
4. Concrete shall have a moisture emission rate of no more than 5 lbs. per 1000 sq. ft. per 24-hour period as determined by proper Calcium Chloride Testing or 90 RH via in-Situ Probe tests
5. Existing Painted Surfaces: “Float” walls using product acceptable to Manufacturer to achieve a smooth flat surface acceptable to receive Key MMA material systems.

B. Bond Testing
1. The Applicator shall evaluate all surface preparation by conducting bond tests at strategic locations.
2. Mix six (6) ounces of the primer to be used in the application with #10-#12 mesh, dry quartz sand until an easily trowelable mixture is obtained. Add 10% by volume Key 9000 MMA Hardener (BPO Powder) and mix well. Apply palm-sized patties 1/8" to 1/4" thick.
3. After one (1) hour at 68° F, patties must be cured tack-free in ambient temperature of concrete.
4. Remove patties with hammer and chisel and examine fracture/delamination plane. Concrete with fractured aggregate must be attached when this has been completed.
5. If only laitance or a small amount of concrete is attached or if interface between patty and substrate is tacky, further substrate preparation is required.
6. If further surface preparation is required, bond tests shall be conducted again when this has been completed.
7. If no amount or kind of surface preparation produces satisfactory bond tests, the applicator shall report that to the Owner, Architect, and Manufacturer.

C. Mechanical Surface Preparation and Cleaning
1. All accessible concrete floor surfaces shall be mechanically blast cleaned using a mobile steelshot, dust recycling machine such as BLASTRAC, as manufactured by Wheelabrator Corp., or approved equivalent. All surface and embedded accumulations of paint, toppings, hardened concrete layers, laitance, power trowel finishes, and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a profile similar to 40 grit sandpaper and exposing the upper fascia of concrete aggregate.
2. Floor areas inaccessible to the mobile blast cleaning machines shall be mechanically abraded to the same degree of cleanliness, soundness, and profile using vertical disc scarifiers, starwheel scarifiers, needle guns, scabblers, or other suitably effective equipment.

3. After blasting, traces or accumulations of spent abrasive, laitance, removed toppings, and other debris shall be removed with brush or vacuum.
4. Conduct Bond Tests to check adequacy of surface preparation. See Paragraph 3.3.B (Bond Testing).
5. Application of the respective specified material system(s) must be completed before any water or other contamination of the surface occurs.

3.4 INSTALLATION

A. Application of Key 9418 MMA Binder. Colored Flake Flooring System consists of:
1. Applying the primer/sealer
2. Applying coving (if required)
3. Performing patching and sloping with Key MMA Polymer Concrete (if required)
4. Re-priming with 9122 over MMA Polymer Concrete areas
5. Applying the topping, broadcasting the Colored Flake
6. Applying the topcoat: Time for curing (45 - 60 minutes) shall be allowed between each coat. Thicknesses are specified below and/or in Paragraph 3.8.

B. Open only the containers of component materials to be use in each specific application as needed. Refer to Manufacturer's data sheets for pot-life/temperature relationship to determine size of batches to mix and mix ratios for each respective coat of the system.

C. Measure, add, and mix the initiator Key 9000 MMA Hardener (BPO Powder Hardener) into the respective resin components in the proportions recommended by the Material Manufacturer. Pot life is short, so mix only as much material at a time as can be easily and efficiently applied.

3.5 PRIME COAT

A. Measure, add, and mix the initiator component, and initiator (SRS Powder Hardener) into the respective resin components in the proportions recommended by the Material Manufacturer.

B. Pour the mixture batches onto the floor surface and use a 9" or 18" wide, 1/2" - 3/4" thick-napped, solvent-resistant paint roller to roll out the material at a rate of 100 sq. ft./ gal. to form a uniform, continuous film, ensuring that all crevices, cracks, other surface discontinuities have been saturated and coated. Use a paint brush to reach areas inaccessible to the roller. Work quickly and deliberately; the pot life is short (10 -15 minutes). Do not leave any "puddles"; roll out any such accumulations.

C. Allow the primer/sealer coat to cure.

D. If any of the concrete has absorbed all of the primer or if the concrete still has a dry look, reprime these areas before applying Wearcoat or Topcoat.

3.6 COVING

A. Surface Preparation
1. If concrete walls are to be painted prior to installation of cove base, the bottom portion of the walls shall remain un-coated to the height of the cove base to insure a proper bond to the concrete wall.

2. If walls are constructed of a non-compatible material or if a coating exists, a backer board of ¼" plexiglass or ½" cement board cut to the desired height of the cove base needs to be installed. The top of the backer board should be cut at a 45° angle to create a "beveled" edge.
3. If a backer board needs to be installed it shall be fastened using a high-grade construction adhesive as well as counter sunk screws or concrete masonry anchors.

B. System Description
1. Cove base shall be installed according to manufacturers recommendations and shall be one of two systems:
   a. CB Filler Cove Base consisting of "spooned in" radius and brush on body coat.
   b. Trowel-On Cove Base consisting of a trowel applied radius/base mix with a termination strip installed at the top of the base.

C. Cove base will receive a broadcast and top coat consistent with flooring system.

3.7 PATCHING/SLOPING

A. Measure, add, and mix the R17 Resin, Powder Component, and necessary aggregate (if required) in the proportions recommended by the Material Manufacturer.

B. Use mixture to repair any damaged concrete, or to slope any areas as needed. Apply to masonry wall surfaces so that existing mortar joints do not telegraph to final top coat finishes.

C. Once cured, material must be re-primed before topping system is applied.

3.8 TOPPING

A. Size the batches and mix according to Manufacturer's instructions. The entire batch should be poured and spread at once, i.e., do not let material set in pail.

B. Spread the topping material with a gauge rake set to a depth of 1/8". Lightly trowel to a uniform thickness of 1/8" as necessary.

C. Immediately after application, roll with a porcupine roller available from the Manufacturer to release any trapped air from the topping.

D. Broadcast Colored Flake into the fresh material before it begins to cure. It is important that the flake "rains" down, and not be thrown into, the surface.

E. Allow the topping to cure.

F. Remove excess flakes by sweeping, "blow-down", and/or vacuuming. Lightly abrade surface to remove loosely bonded Colored Flake with a medium-stiff brush on a swing style floor machine or abrade using med-coarse fiber pad, or stiff bristle push-broom. Vacuum prior to next step.

3.9 TOP COAT

A. Apply with clean rollers at a rate of 100 - 125 sq. ft./gal. in the same way as the Primer/Sealer was applied as described in Paragraph 3.5.B.

B. (If Required) Broadcast aluminum oxide, glass beads, or other suitable material into wet topcoat resin; size and rate as determined by owner.

C. Allow topcoat to cure. Floors without aluminum oxide or glass bead broadcast may be lightly sanded if required. Vacuum all dust, paying particular attention to edges and corners.

3.10 SECOND TOPCOAT

A. Apply with clean rollers at a rate of 100 - 125 sq. ft./gal. in the same way as the Primer/Sealer was applied as described in Paragraph 3.5.B.

B. Allow topcoat to cure.

3.11 FIELD QUALITY CONTROL/INSPECTION

A. Applicator shall request acceptance of surface preparation from the Engineer before application of the prime/seal coat.

B. Applicator shall request acceptance of the prime/seal coat from the Engineer before application of subsequent specified materials.

C. All work not acceptable to the Architect, Engineer, or Owner must be corrected before consideration of final acceptance.

3.12 CLEANING

A. Applicator shall remove any material spatters and other material that is not where it should be. Remove masking and covers taking care not to contaminate surrounding area.

B. Applicator shall repair any damage that should arise from either the application or clean-up effort.

3.13 COATING SCHEDULE

A. Primer shall be R41i. Application rate shall be approx. 100 sq.ft. per gallon (approx. 12 mils).

B. Coving shall be R61 with appropriate filler installed per manufacturers recommendations.

C. Patching/Sloping material shall be R17

D. Body coat shall be R61SL applied with a gauge rake set at 1/8" for a rate of 40 sq. ft. per batch. Colored Flake to be broadcast into the uncured topping. Broadcast the Colored Flake at the rate of 0.10 – 0.15 pounds per sq. ft.

E. Clear topcoat shall be R71; apply at the rate of 100 - 125 sq. ft. per gallon for the first coat and 100 - 125 sq. ft. per gallon for the second application.

3.14 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 68 16 - VINYL BACKED CUSHIONED CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sheet carpet.
2. Carpet accessories.

B. Related Sections:

1. Division 9, Section “Resilient Base and Accessories” for resilient base, reducer strips, and other accessories installed with carpet.

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.3 DESCRIPTION

A. The project consists of floor surface preparation and the installation of new carpeting, entry mat carpet tile, and other related work as required for a complete and finished product.

B. The work shall include the furnishing of all labor, tools, equipment, material, supervision, coordination, transportation, and the performance of all operations and related items required to provide the above-mentioned work and shall include the cleanup and removal from the site of all debris resulting from the operations performed. It shall also be the Contractor's responsibility to take all necessary safety precautions and to furnish barricades and/or any safety measures as may be required to complete the recarpeting as shown on the Drawings, and further described in the Specifications and Contract Documents.

1.4 QUALITY CONTROL

A. All carpet shall be from the same dye lot. On-site storage of carpet for future phases will not be available. The Contractor shall provide carpet storage per manufacturer’s recommendations between Phases.

B. The Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this specification.

C. If in the opinion of the Owner, insufficient numbers of workmen are being utilized to finish the project within the specified time, the owner may request more workmen.

D. Where a particular manufacturer and its model number or name is mentioned in connection with any item, they are listed to illustrate the **only** products that are acceptable to the District. **No substitutions will be evaluated or accepted.**

E. The owner will award the bid with the understanding that the bids received were based upon the specified materials.

F. Installation must be performed by a firm with not less than five (5) years of experience in installation of commercial carpet, by methods similar to those required for this project.

G. Installation must be performed by an installer that is approved by the manufacturer to coordinate with warranties offered by the manufacture.

H. Manufacturer is required to notify Owner, Architect, and General Contractor if installation instructions are not completely followed.

I. Manufacturer must have been in continual operation for a minimum of ten years.

J. Manufacturer will be on site to review startup of carpet installations to verify proposed installation procedures are correct and proposed seaming procedures are done in a proper fashion to stand by any warranties especially in the case of seams and carpet adhesion to substrate. **Written verification of review and acceptance of these startup installation procedures will be required by the Owner**. In addition, Manufacturer will be on site to review all installations within a three (3) month period **after** installation is complete to verify installation is correct and seaming was done in a proper fashion to stand by any warranties especially in the case of seams and carpet adhesion to substrate. **Written verification of review and acceptance of the completed installation will be required by the Owner.**

1.5 SUBMITTALS

A. Contractor shall submit samples of each color pattern of carpet available for the Owner's review for selections. Colors and patterns submitted for selection shall be available to meet the project schedule. Contractor shall also submit the manufacturer's specifications covering the manufacture of the carpeting which they are proposing. The specifications shall include all minimum material specifications as listed in Section 2.1 (B).

B. Contractor shall submit within fifteen (15) calendar days after the receipt of the Owner's Notice to Proceed, but before work begins. Manufacturer's recommended installation procedures which, when approved by the Owner, will become the basis for accepting or rejecting actual installation procedures used on the work.

C. A Seaming Diagram **will be required.** Field seaming shall be discussed with and agreed to by the District representative prior to installation.

1. Classroom Seaming Layout: The seams in the classrooms shall run perpendicular to the corridor wall.

D. Maintenance Manual: After award of bid, the Contractor shall furnish the Owner at least three (3) printed copies of the manufacturer's recommendation for the care, cleaning and maintenance of the carpet furnished and thoroughly instruct the Owner's maintenance personnel in the care, cleaning, and maintenance of the carpet if requested. This instruction shall happen once.

1.6 TESTING

A. The Owner may decide that testing is required in order to establish conformance with these specifications. The Owner will select a prequalified independent testing laboratory should it be required. All testing will be in accordance with all pertinent codes and regulations and with selected standards of the American Society of Testing and Materials. All testing and retesting costs will be paid for by the Owner, except as otherwise directed in these specifications.

B. It shall be the Contractor's responsibility to, at all times, cooperate with the testing laboratory. Representatives of the testing laboratory shall have access to the work at all times and at all locations where the work is in progress. All specimens and samples for testing shall be taken by the testing personnel or Owner. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory or the Owner. The Contractor shall establish with the testing laboratory a schedule of time to perform tests. If changes occur in this schedule, the Contractor shall coordinate all such changes with the testing laboratory. If the testing laboratory is prevented from taking specimens or testing due to uncoordinated time changes or incompleteness of the work, all extra charges for testing attributable to the delay will be back charged to the Contractor and shall not be borne by the Owner.

1.7 PRODUCT HANDLING

A. Except as otherwise approved by the Owner, determine and comply with manufacturer's recommendations on product handling, storage, and protection. The Contractor shall provide all storage of materials used throughout this section.

B. Deliver products to the job sites in their manufacturer's original container, with labels intact and legible. Maintain packaged materials with seals unbroken and labels intact until time of use. Carpet rolls shall have register number and tag attached or register numbers stenciled on bale and intact until time of use.

C. The Owner may reject as noncomplying such material and products that do not bear identification satisfactory to the Owner as to manufacture, grade, quality, and other pertinent information as specified.

D. The Contractor shall promptly remove damaged material and/or unsuitable or rejected items from the job site, and promptly replace with materials meeting the specified requirements, at no additional cost to the Owner.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

PART 2 - PRODUCTS

2.1 VINYL BACKED CUSHIONED CARPET

A. The specifications for carpeting outlined below are for the purpose of establishing quality standards required under the contract. Only the manufacturer's and products listed will be acceptable. There will be no evaluations of other products prior to bid, nor will their be any substitutions reviewed or allowed. Failure to submit a bid utilizing one of the listed products will be cause for rejection of the bid.

B. Carpet – General
1. All materials shall be new and of domestic manufacture. Carpet of each type is to be of first quality and from one dye lot.
2. All carpet to have built-in permanent static control, anti-microbial treatment, soil and stain protection treatment, and a moisture barrier backing.

C. Material Specifications

1. Construction/Face Pattern:

a. Level Loop.
b. 8.5 stitches per square inch
c. 13th Gauge or higher
d. Primary Backing: Non-woven synthetic fiber
e. Width: 6 feet
f. Tuft Density: 108.8 tufts/sq in
g. Pile Height Average: 0.117 inch
h. Pile Thickness: 0.081 inch
i. Primary Tufting Substrate: Synthetic Non-Woven

2. Yarn System:

a. Antron Legacy Nylon
b. Face weight **no greater** than 22 oz. and **no less** than 18 oz.

3. Backing System:

a. Closed Cell Vinyl Cushion – ASTM D 1667; Min. 7 psi @ 25%; Max. 25 psi @ 25%
b. Permanently fused to tufting blanket
c. No Moisture Penetration in field or seams after 10,000 Impacts.
d. No backing degradation after 50,000 cycles from Phillips Chair Caster Test

4. Installation System:

a. Factory supplied non-wet, low VOC adhesive
b. No off-gassing required
c. **Permanent chemically welded seams**
d. No seam degradation after 50,000 cycles from Phillips Chair Caster Test

5. Sustainability: Manufacturer guarantees in writing that if materials are sent back for recycling, none will be landfilled or incinerated.

D. Approved Carpet: Furnish carpet of one of the following, subject to meeting material, performance and warranty requirements of this Section.

1. Tarkett Flooring: textured patterned loop pile carpet with “Powerbond RS” backing; 18 ounce yard face weight minimum. Furnish in 6-foot wide rolls with low VOC non-wet peel and stick adhesive installation.

a. Flooring Type F1:
    a. Style: Primary Colors Collection #11906
        i. Color: “Energy” #55306
b. Flooring Type F1A:
    a. Style: : Primary Colors Collection #11906
        i. Color: “Moonray” #55307

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Owner.

PART 3 - EXECUTION

3.1 SURFACE AND CONDITIONS

A. Examine all areas and conditions under which work will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until satisfactory conditions are corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

At contractor’s option, ridges at joints and slab edges may be ground using pwered grinding equipment.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 CARPET INSTALLATION

A. Align the lines of carpet, as woven, using no fill strips less than 12" wide. Lay all carpet in the same direction unless specifically directed otherwise by the Owner.

B. Locate seams only where specifically approved by the Owner. Locate seams to the maximum extent possible out of the way of traffic. Fabricate seams by the compression method, using a butt joint and properly chemically weld, bead and seal.

C. After installation: When installation is completed, clean up all dirt and debris, clean carpet of all spots. Remove all loose threads with scissors. Vacuum carpet.

D. Where any Tarkett Flooring is installed, specifically peel-and-stick 6' wide rolls of Color Spectrum carpet, the contractor shall be responsible for contacting:

Tarkett Flooring
Mike Milhous, LEED AP e-mail: mmilhous@tandus.com
3702 Sudor Lane, Loomis CA 95650
Cell: (916) 806-8502 Fax: (916) 765-2839

for a post-installation inspection by the carpet manufacturer.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

PART 4 - GUARANTEE

4.1 MANUFACTURER'S WRITTEN WARRANTY

A. All of the product related warranties listed below must be submitted as published warranties and presented as sample copies prior to approval. The originals must be signed by an official of the corporation that manufactures the carpeting and submitted to the Owner after installation is complete.

1. Specification Warranty: The manufacturer warrants that the carpet conforms to specifications established for the product identified in the execution section, subject to normal manufacturing tolerances.
2. Two Year Installation Workmanship: Provide special project warranty, signed by Contractor and installer, agreeing to repair or replace defective materials and workmanship of carpeting work during 2-year warranty period, without cost to Owner; and agreeing to repair or replace other defects beyond Contractor's/Installer's/Manufacturer's controls, as judged by Architect, at Owner's expense at prevailing rates.
3. 10 Year non-prorated Wear Warranty: This carpet is warranted by the manufacturer for indoor commercial use. This manufacturer guarantees that the surface fiber of this carpet will wear less that 10% by weight from abrasion over a period of 10 years from the date of installation. Any area showing greater wear under conditions of normal use will be replaced at the manufacturer's expense including labor charges, as long as the carpet was properly installed and maintained.
4. 10 Year non-prorated Adhesive Warranty: The Manufacture warrants that the carpet will remain attached to the substrate for a period of twenty (10) years from the date of installation.
5. 10 Year non-prorated Edge Ravel Warranty: The Manufacture warrants that the carpet will not have continuous ends coming out of lengthwise seams for a period of 10 years from the date of installation.
6. 10 Year non-prorated Zippering Warranty: The Manufacturer warrants that the carpet will not develop "pile yarn runners" in the body of the carpet for a period of twenty (10) years from the date of installation.
7. 10 Year non-prorated Delamination Warranty: The Manufacturer warrants that the carpet will not delaminate for a period of 20 years from the date of installation.
8. 10 Year non-prorated Texture Retention Warranty: The Manufacturer warrants that the carpet will substantially maintain its physical surface texture against crushing, matting and walking out for a period of twenty (10) years from the date of installation.
9. 10 Year non-prorated Run Resistance Strength Warranty: The Manufacturer warrants that the carpet will not zipper or develop continuous "pile yarn runners" for a period of twenty (20) years from the date of installation.
10. 10 Year non-prorated Colorfastness to Light Warranty: The Fiber Manufacturer warrants that when installed for indoor use only, the carpet will not display or significantly change color due to exposure to light for twenty (10) years from the date of installation. (Applies only to Antron Lumena)
11. Colorfastness to Atmospheric Contaminants Warranty: The Fiber Manufacturer warrants that when installed for indoor use only, the carpet will not display or significantly change color due to the atmospheric contaminants (Ozone or Oxides of Nitrogen) for five (5) years from the date of installation. (Applies only to Antron Lumena)

END OF SECTION 09 68 16

SECTION 09 72 60 – TACKABLE WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Resilient cork/linoleum tackable wallcovering.

B. Related Sections:
   1. Division 09 Section "Interior Painting" for priming wall surfaces.
   2. Section 07 92 00 – “Joint Sealants” for caulking perimeter at walls.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.

C. Samples for Initial Selection: For each type of wall covering and trim indicated.

D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

E. Qualification Data: For qualified testing agency.

F. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics Classification: Provide materials that meet classification ratings below: ASTM E84 (Flame Spread and Smoke Developed) II/B.

B. Single Source Responsibility: Obtain tackable wallcovering system components from a single source.

C. Deliver materials in original factory packaging, labeled with manufacturer, brand name, size, color, and lot number.

D. Store materials in original, undamaged packaging inside a well-ventilated area protected from weather, moisture, soiling, and extreme temperatures. Maintain room temperature within the storage area at not less than 68° F (20° C) during the period materials are stored.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F1141.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period. Maintain ambient temperature within the building at not less than 68° F (20° C) for a minimum of seventy-two hours prior to beginning of installation.

B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.6 WARRANTY

A. Submit manufacturer’s limited five-year written warranty against manufacturing defects.

PART 2 - PRODUCTS

2.1 WALL COVERINGS

A. General: Provide rolls of each type of wall covering from same print run or dye lot.

2.2 TACKABLE WALL COVERING W3

A. General: Uni-color resilient homogeneous tackable linoleum surface consisting of linseed oil, granulated cork, rosin binders, and dry pigments calendered onto natural burlap backing. Color shall extend through thickness of material.
   1. Width: 48-inch, Gauge: 1/4 inch. Approximately ± 95 lineal foot rolls. Flexible enough to bend around a 2-3/4-inch radius. Dimensionally stable due to burlap backing.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Manufacturer: Koroseal Interior Products Group: Walltalkers “tac•wall”.
   a. Color: To be selected by Architect from manuf. full range
   b. Product No. C250-86
2. Manufacturer: Forbo Flooring Systems: “Bulletin Board”.
   a. Color: To be selected by Architect from manuf. full range

2.3 ACCESSORIES

A. Adhesive: Solvent-free, SBR type linoleum adhesive (L-910)

B. Color matched caulk.

C. Aluminum Trim:
   1. JT12-00: Clear satin, anodized aluminum, 1/4 inch (6 millimeter) J trim
   2. IST12-00 Clear satin, anodized aluminum, ¼ inch (6 millimeter) Inside corner
   3. OST12-00 Clear satin, anodized aluminum, ¼ inch (6 millimeter) Outside corner
   4. DIV12-00 Clear satin, anodized aluminum, ¼ inch (6 Millimeter) divider moldings

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
   1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
   2. Gypsum Board: Prime with acrylic primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
   3. CMU: ‘Float’ walls using USG or Hamilton’s All-Purpose Mud to achieve a smooth flat surface. Prime with acrylic primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION

A. Comply with manufacturer's printed installation instructions.

B. Cut sheets to size including a few inches of overage. Allow sheets to lay flat for at least twenty-four hours prior to the application. Mark roll direction and sequence on the backside of each sheet. Hang sheets in sequence as cut from the roll, do not reverse sheets.

C. Permanent HVAC system should be set to 68° F (20° C) for at least seventy-two hours prior to, during, and after the installation.

D. Back roll each sheet prior to the installation to release curl memory.

E. For seamed applications, using a seam and strip cutter remove the factory edge of one sheet. Using the same tool, overlap and trace cut the mating edge of the second sheet. Repeat this step for as many sheets as required for the job.

F. Use aluminum j trim on all sides or inside and outside corners where applicable.

G. Apply adhesive with a 1/16-inch square notch trowel to the area receiving the sheet (apply enough for one sheet at a time).

H. Work from top to bottom then side to side. Roll sheet firmly into adhesive for positive contact and to remove air bubbles.

I. Remove adhesive residue immediately after each panel is hung with a mild soap/water solution and a soft cloth/sponge

J. Clean wallcovering using a sponge with a neutral pH cleaning solution. Do not use abrasive cleaners. Rinse thoroughly with water and let dry before using.

K. It is important to remove adhesive while wet.

L. Sand or file corners and cut ends of aluminum trim to remove sharp corners and edges.

M. Caulk visible exposed ends of aluminum corner pieces, where occurs.

N. Caulk edge of perimeter trim to match wall (gypsum board and/or CMU).

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 60

SECTION 09 77 20 – FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.
   1. Aluminum trim.

B. Products Not Furnished or Installed under This Section:
   1. Gypsum substrate board.
   2. Resilient Base.

1.2 RELATED SECTIONS

A. Section 09 29 00 – Gypsum substrate board.

B. Section 09 22 16 - Metal Stud Framing

C. Section 09 91 23 – Interior Painting.

D. Section 09 65 13 - Resilient Base.

1.3 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)
   1. ASTM D 256 - Izod Impact Strengths (ft #/in)
   2. ASTM D 570 - Water Absorption (%)
   3. ASTM D 638 - Tensile Strengths (psi) & Tensile Modulus (psi)
   4. ASTM D 790 - Flexural Strengths (psi) & Flexural Modulus (psi)
   5. ASTM D 2583- Barcol Hardness
   6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
   7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
   1. Submit complete with specified applied finish.
   2. For selected patterns show complete pattern repeat.
   3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.5 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
   1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
      a. Wall Required Rating – Class A.

B. Sanitary Standards: System components and finishes to comply with:
   1. United States Department of Agriculture (USDA) requirements for food preparation facilities, incidental contact.
   2. Food and Drug Administration (FDA) 1999 Food Code 6-101.11.
   3. Canadian Food Inspection Agency (CFIA) requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70°) for 48 hours prior to installation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work.

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
   1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.8 WARRANTY

A. Furnish a one-year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Marlite; 202 Harger Street, Dover, OH 44622. 800-377-1221, FAX (330) 343-4668, Email: info@marlite.com , Web: www.marlite.com.

B. Basis-of Design Product: Subject to compliance with requirements, provide Marlite Standard FRP panels, or comparable product.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600

2.2 PANELS

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
2. Dimensions:
   a. Thickness – 0.090 “ (2.29mm) nominal
   b. Width - 4'-0” (1.22m) nominal
   c. Length – [10’-0” (3.0m)] nominal
3. Tolerance:
   a. Length and Width: +/-1/8 “ (3.175mm)
   b. Square - Not to exceed 1/8 “ for 8 foot (2.4m) panels or 5/32 “ (3.96mm) for 10 foot (2.4m) panels

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
1. Flexural Strength - 1.0 x 10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
2. Flexural Modulus - 3.1 x 10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
3. Tensile Strength - 7.0 x 10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
4. Tensile Modulus - 1.6 x 10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
5. Water Absorption - 0.72% per ASTM D 570.
6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256

C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.

D. Front Finish:
1. All areas except Mechanical Room B109:
   a. Color:
      1) Marlite Standard FRP.
         a) P199 Bright White
   b. Surface: Pebbled
   c. Fire Rating: Class A (I) Fire Rating.
   d. Size:
      1) Marlite FRP
         a) 48” x 96” [1.2m x 2.4m] x .090” (3mm) nom.

2. At Mechanical Room B109:

e. Color:
1) Marlite Smooth Surface FRP.
a) S 100 S/2/S White

f. Surface: Smooth

g. Fire Rating: Class A (I) Fire Rating.

h. Size:
1) Marlite FRP
a) 48” x 96” [1.2m x 2.4m] x .090” (3mm) nom.

2.3 MOLDINGS

A. Aluminum Trim: Heavy weight extruded aluminum 6063-T5 alloy prefinished at the factory.
1. Color: Brite Anodized

2.4 ACCESSORIES

A. Fasteners: Non-staining nylon drive rivets.
1. Match panel colors.
2. Length to suit project conditions.

B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
1. Titebond Advanced Polymer Panel Adhesive – VOC compliant, non-flammable, environmentally safe adhesive.

C. Sealant:
1. Marlite Brand MS-251 White Silicone Sealant.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
1. Verify that stud spacing does not exceed 24” (61cm) on-center.

B. Repair defects prior to installation.
1. Level wall surfaces to panel manufacturer’s requirements. Remove protrusions and fill indentations.

3.2 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8” (3 mm) clearance for every 8 feet (2.4m) of panel.
   1. Cut and drill with carbide tipped saw blades or drill bits or cut with shears.
   2. Pre-drill fastener holes 1/8” (3mm) oversize with high-speed drill bit.
      a. Space at 8” (200mm) maximum on center at perimeter, approximately 1” from panel edge.
      b. Space at in field in rows 16’ (40.64cm) on center, with fasteners spaced at 12” (30.48 cm) maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
   1. Install panels with manufacturer's recommended gap for panel field and corner joints.
      a. Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.
      b. Drive fasteners for a snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
   1. All moldings must provide for a minimum 1/8 “ (3 mm) of panel expansion at joints and edges, to insure proper installation.
   2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

E. All trim and molding joints and corners shall be free of burrs and sharp edges.

3.3 CLEANING

A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION 09 77 20

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Requirements:

1. Section 05 10 00 - “Structural Steel” for the painting of structural steel members.
2. Section 05 50 00 - “Metal Fabrications” for the painting of miscellaneous metal fabrications.
3. Section 08 11 13 - “Hollow Metal Doors And Frames “for the painting of hollow metal doors and frames.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel
2. Concrete Masonry Units (CMU)

B. Related Sections include the following:

1. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with Washoe County School District standard requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Glidden
2. Sherwin-Williams
3. PPG
4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range and/or to match Owner's custom color.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated - unless otherwise noted.

1. In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 851-5675.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: clean thoroughly, scrape and sand with all visible rust removed from surface. A “Rust Converter” such as Jasco Prep and Prime shall be applied to all surfaces that have rust damage. All glossy paint, bare metal, and areas primed with “Rust Converter” to be primed with a Latex All-Purpose Bonder, Primer and Sealer – Zinseer 1-2-3 or equal.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

F. Patching of all surfaces to be done **after** substrate is spot primed and allowed 24 hours to dry. Patching should be flush with the existing surface and match the texture of the existing surface. The patched area needs to be spot primed after patching compound has had the proper cure/dry time according to manufacturer’s recommendations.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates: All exposed to view steel substrates including hollow metal door frames, columns, beams, gate frames, etc. that do not have a factory finish, or are not galvanized.

1. Semi-Gloss Acrylic DTM System:
   a. Rust Converter: Jasco Prep and Prime (or equal)
   b. Prime Coat: Glidden Professional; Gripper Interior/Exterior Primer/Sealer, GP-3210-1200
   c. Intermediate Coat: PPG Architectural/Glidden High Performance Coatings; Pitt-Tech Plus Int/Ext High Gloss DTM Industrial Enamel; 90-1310.
   d. Top Coat: PPG Architectural/Glidden High Performance Coatings; Pitt-Tech Plus Int/Ext High Gloss DTM Industrial Enamel; 90-1310.
   e. Galvanized-metal substrates should not be chromate passivated (commercially known as "bonderized") if primer is field applied. If galvanized metal is chromate passivated, consult manufacturers for appropriate surface preparation and primers.

B. CMU Substrates

1. Semi-Gloss Latex System
   a. Prime Coat: Exterior, latex block filler.
   b. Intermediate Coat: Matching topcoat.
   c. Topcoat: Exterior late paint, semigloss.

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Steel.
   2. Gypsum board.

B. Related Sections include the following:

   1. Section 05 10 00 - “Structural Steel” for the painting of exposed steel.
   2. Section 05 50 00 - “Metal Fabrications” for the painting of miscellaneous metal fabrications.
   3. Section 08 11 13 - “Hollow Metal Doors and Frames “for the painting of hollow metal doors and frames.
   4. Section 09 91 13 - "Exterior Painting" for surface preparation and the application of paint finishes on exterior substrates.
   5. Section 07 92 00 – “Joint Sealants” for various surfaces to receive paint.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. MPI Standards:
   1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with Washoe County School District standard requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Glidden
   2. Sherwin-Williams
   3. PPG
   4. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: To match Washoe County School District Standard Colors.
   1. Contractor to allow for 15% of all gypsum wallboard surfaces to receive a deep tone accent color. Up to four different accent colors will be used.
      a. Colors to be selected by architect.

C. **All products shall be "0 (Zero) Lead", utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 775-851-5675.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Architecturally exposed structural steel shall be protected from spills, splatter and drips during construction.

B. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

C. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Masonry (Clay and CMU): 12 percent.
   2. Gypsum Board: 12 percent.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
   1. In addition, all work will be completed, as a minimum, utilizing the lead safe work practices identified in the EPA Guidance Document titled "Steps to Lead Safe Renovation, Repair and Painting", pages 12 thru 23. This document is available electronically by contacting the WCSD RS&A Department at 775-851-5675.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: Finishes on exposed steel members shall result in an Architecturally acceptable finish.
   1. Before applying finish coat:
      a. Remove rust and loose mill scale.
      b. Remove any drips, runs, sags, wrinkling or webbing from the primer coat.
      c. Remove drips, and splatter from work above.
      d. Clean using methods recommended in writing by paint manufacturer.
      e. Re-prime as necessary.

E. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

F. Galvanized Metal: Allow to weather a minimum of 6 months prior to coating. Clean per Society for Protective Coatings SSPC-SP1 using detergent and water or a degreasing cleaner, then prime as required. When weathering is not possible or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test area, priming as required. Allow coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.

G. Concrete Substrates: Concrete must be cured at least 28 days @ 75 degrees F. Remove all loose droppings and foreign material. Surface must be free of laitance, concrete dust, dirt, form releaser agents, moisture curing membranes, loose cement and hardeners. Fill bug holes, air pockets and other voids with manufacturer's recommended product. Follow manufacturer's surface preparation information.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
   1. Mechanical Work:
      a. Uninsulated metal piping.
      b. Uninsulated plastic piping.
      c. Pipe hangers and supports.
      d. Tanks that do not have factory-applied final finishes.
      e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
      f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
   2. Electrical Work:
      a. Switchgear.
      b. Panelboards.

c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Steel Substrates: All steel substrates exposed to view including hollow metal door frames, stair railings, structural steel columns, structural steel beams, joists, metal decking, electrical conduits, plumbing piping, mechanical ductwork, etc.
   1. Alkyd System: MPI INT 5.1E.
      a. Bottom Coat: Glidden Professional; Alkyd Semi-Gloss Paint; GP-1507
      b. Intermediate Coat: Interior alkyd matching topcoat.
      c. Topcoat: Glidden Professional; Alkyd Semi-Gloss Paint; GP-1507

B. Gypsum Board & Plywood Substrates:
   1. Latex System: MPI INT 9.2A.
      a. Prime Coat: Glidden Professional; PVA Drywall Interior Primer and Sealer, GPD-0000
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Glidden Professional; Diamond 450 Interior Premium Acrylic Satin; GP-7400

C. Concrete Substrates: All concrete slab substrates designated to receive epoxy paint.
   1. Epoxy System: MPI 82
      a. Bottom Coat: Sherwin Williams ArmorSeal 33 Epoxy Primer/Sealer
      b. Intermediate Coat: Sherwin Williams ArmorSeal 1000 HS Epoxy coating matching topcoat.
      c. Topcoat: Sherwin Williams ArmorSeal 1000 HS Epoxy coating.

END OF SECTION 09 91 23

SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1.
2. Markerboards. – wall mounted.

B. Related Requirements:
1. Section 09 22 16 - “Non-Structural Metal Framing” for backing to support visual display surfaces.

1.3 DEFINITIONS

A. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

B. Samples for Verification: For each type of visual display surface indicated.
1.
2. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
3. Trim: 6-inch- long sections of each trim profile.
4. Display Rail: 6-inch- long sections.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

B. Maintenance Data: For visual display surfaces to include in maintenance manuals.

C. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1.
   2. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces exhibit crazing, cracking, or flaking.
   3. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, ½" thick core material, and porcelain-enamel face sheet with low-gloss finish.
   1.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ADP Lemco, Inc.
      b. Best-Rite Manufacturing: (Basis of Design).
      c. Claridge Products and Equipment, Inc.
      d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 MARKERBOARD AND ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from extruded aluminum; standard size and shape.
   1. Factory-Applied Trim: Manufacturer’s standard.

B. Chalktray: Manufacturer’s standard, continuous.
   1.
   2. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

C. Map Rail: Provide the following accessories:
   1.
   2. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
   3. End Stops: Located at each end of map rail.

2.3 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
   1.
   2. Surface is magnetic for added versatility.

B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.
   1.
   2. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1.
   2. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
   1.
   2. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.6 VISUAL DISPLAY SURFACES – WALL MOUNTED

A. Visual Display Board: Factory assembled.
1.
2. Markerboard: Porcelain-enamel markerboard assembly.
   a. Color: White.
3. Corners: Square.
4. Width: As indicated on Drawings.
5. Height: As indicated on Drawings.
6. Mounting: Wall.
7. Mounting Height: As indicated on Drawings.
8. Factory-Applied Aluminum Trim: Manufacturer's standard with clear anodic finish.
9. Accessories:
   a. Chalktray: Solid type.
   b. Map rail with display rail end stops.

B. VisualDisplay Surface Schedule:
1.
2. Bestrite 202AH 4' x 8' Marker Board Porcelain Steel (608513) with map rail & dura-safe end caps packed & shipped in singles.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display surfaces.

C. Examine doors for proper preparation for visual display surfaces.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, brackets, anchors, trim, and accessories necessary for complete installation.

3.3 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall and door surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

3.4 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Panel signs.
   2. Photo-etched zinc signs.
   3. Owner furnished; contractor installed exit map frames.

B. Related Requirements:
   1. Section 22 05 53 - "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
   2. Section 23 05 53 - "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
   3. Section 26 05 53 - "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Full-size Sample.
2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
3. Exposed Accessories: Full-size Sample of each accessory type.

E. Submit 2 full size sample zinc-etched signs, illustrating thickness, etching depth, letter size and Braille characters.

F. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 SYSTEM DESCRIPTION

A. Signage package shall consist of room number and room usage signage to meet the requirements of Americans with Disabilities Act, Section 504 of the Federal Rehabilitation Act, ICC/ANSI A117.1-2003, and U.S. Public Law 92-112 (1986).

B. Signage design and installation shall comply with Americans with Disabilities Act Accessibility Guidelines (ADAAG), latest edition.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.

c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Accessibility Standard: Comply with applicable provisions in ICC A117.1 for signs.

2.2 PANEL SIGNS

A. Panel Sign: Sign with message and characters having uniform faces, and precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: Mohawk Sign Systems, Inc.; Process Series 200A - Sand Carved Format D.
   a. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Engraved Plastic-Laminate Sign: Plastic-laminate face laminated to contrasting phenolic core to produce composite sheet.

   a. Composite-Sheet Thickness: 0.25 inch.
   b. Engraved Graphics: Characters engraved through plastic-laminate face sheet to expose contrasting phenolic core.

      1) Tactile characters shall be raised the required 1/32" inches from sign face. Glue-on letters or etched backgrounds are not acceptable.
      2) All text shall be accompanied by Grade 2 braille. Braille shall be separated 1/2" from the corresponding raised characters or symbols. Grade 2 braille translation to be provided by signage manufacturer.
      3) Perimeter borders shall be 3/8".
      4) All letters, numbers and/or symbols shall contrast with their background, either light characters on a dark background or dark characters on a light background. Characters and background shall have a non-glare finish.

   c. Plastic-Laminate Color and Pattern: As selected by Architect from manufacturer's full range.
   d. Core Color: As selected by Architect from manufacturer’s full range of contrasting colors.
   e. Plaque material shall be melamine plastic laminate. The melamine shall be non-static, fire-retardant and self-extinguishing. The plastic laminate will be impervious to most acids, alkalies, alcohol, solvents, abrasives, and boiling water.
   f. Size of letters and numbers shall be as follows:

      1) Room numbers shall be 3/4"h.
      2) Lettering for room ID signs shall be 3/4"h.
      3) Symbol size shall be 4"h.
      4) Standard Grade 2 braille shall be 5/8" h., located below copy.

g. Copy position: CC (centered/centered)

3. Lettering style shall be Helvetica Medium.

4. Frame: Entire perimeter.

a. Material: Aluminum.
b. Frame Depth: As indicated.
c. Profile: Square.
d. Corner Condition in Elevation: Rounded to radius indicated.
e. Finish and Color: Clear anodized.

5. Mounting: Surface mounted to wall with exposed anchors.

2.3 PANEL-SIGN MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Plastic-Laminate Sheet: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.

2.4 ZINC-ETCHED SIGNAGE

A. Zinc photo-etched metal signs manufactured as follows:
1. Metal alloy to contain 99% zinc.
2. Nominal material depth shall be a minimum of .120 with an etching depth of .040.
3. Color with a minimum 70% contrast as required by ADAAG section 4.30.5: between background and characters. Characters shall be white. Background shall be dark grey. Background and characters shall have matte finish.
4. Sign shall be coated with a graffiti resistant clear coat.
5. Lettering, Braille, and Symbols/Pictographs shall conform to ADAAG section 4.30.4 requiring 1/32 inch raised above background. All characters must be accompanied by Grade 2 Braille.
6. Sizes and quantities as shown on drawings and/or schedule.
7. All work done shall be machine fabricated in accordance with Architect approved shop drawings with straight lines, square corners, or smooth bends, free from perfections which may affect appearance or serviceability. Curved sections shall be formed smooth and even radii. Signs shall be of one-piece construction.
8. Provide predrilled holes for screw attached signs. All signs are screw-attached

B. Lettering style shall be Helvetica Medium.

C. Sizes of letters and numbers shall be as follows:

1. Room numbers shall be 3/4" high.
2. Lettering for room usage identification shall be ¾” inches high.
3. Lettering for rest room identification shall be ¾” inch high.
4. Standard Grade 2 braille shall be 5/8" h., located below copy.

D. Letters and numbers shall be centered on sign.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.

C. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For snap-in changeable inserts beneath removable face sheet, furnish one suction or other device to assist in removing face sheet. Furnish initial changeable insert. Subsequent changeable inserts are by Owner.
2. For frame to hold changeable sign panel, fabricate frame without burrs or constrictions that inhibit function. Furnish initial sign panel. Subsequent changeable sign panels are by Owner.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Methods:

1. Concealed Studs or Fasteners (Frame to substrate): Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
2. Two-Face Tape (Sign to frame): Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position and push to engage tape adhesive.
3. Zinc signage installation shall include the use of two (2) vandal-proof anchors, minimum, per sign, 3 inches or less in height and 4 anchors for larger signs.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 SIGNAGE SCHEDULE

A. As indicated on Drawings.

END OF SECTION 10 14 00

SECTION 10 21 23 CUBICLE CURTAINS & TRACKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cubicle curtains
2. Cubicle curtain tracks.

B. Related Requirements:

1. Section 09 51 23 - "Acoustical Panel Ceilings" for surfaces to hold the cubicle curtain track.

1.2 ACTION SUBMITTALS

A. Product Data: For cubicle curtains and tracks.

1. Manufacturer's Literature and Data

B. Shop Drawings: Showing layout of tracks and method of anchorage.

C. Samples for Initial Selection: For each type of material exposed to view.

1. One 300 mm (12 inch) long piece of cubicle curtain track with carrier access and end stop.
2. One clip anchor for fastening track to grid system of acoustical ceilings.
3. One curtain carrier.
4. Color selection chart for curtain.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For cubicle curtain and track to include in maintenance manuals. Include Product Data for care products used.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify ceiling installation is complete to accept curtain track installation.

PART 2 - PRODUCTS

2.1 CUBICLE CURTAIN TRACKS

A. Surface mounted:

1. Channel Tracks (Surface Mounted Type): Extruded aluminum, ASTM B221, alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain carriers.

B. Curtain Carriers: Nylon or delrin carriers, with either nylon or delrin wheels on metal, delrin, or nylon axles. Equip each carrier with either stainless steel, chromium plated brass or steel hooks with swivel, or nickel chromium plated brass or stainless steel bead chain and hook assembly, or delrin carriers may have moulded on delrin hooks. Hook for bead chain may be the same material and finish as the bead chain or may be chromium plated steel. Provide 2.2 carriers for every 300 mm (onefoot) of each section of each track length, plus one additional carrier.

C. End Stop Connectors, Ceiling Flanges and Other Accessories: Fabricate from the same material with the same finish as the tracks or from nylon.

D. Hangers and Fittings: Fabricate from the same material with the same finish as the tracks. Hangers may be round or square for channel tracks and round for tubular tracks. Design fittings to be compatible with design of tracks and to safely transmit the track load to the hangers.

E. At end of each section of track, make provision for insertion and removal of carriers. Design to prevent accidental removal of carrier. Any operating mechanism shall be removable with common tools.

2.2 CUBICLE CURTAINS

A. Privacy Cubicle Curtains:

1. 100% flame -resistant polyester with 20” polyester mesh top, triple folded with lock stitching at top hem. 1” double folded lock stitched bottom hem.
2. Nickel plated rust proof brass grommets spaced 6” o.c.
3. Permanent stiffeners in side hems.
4. Color to be selected from manufacturer’s standard product line.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install tracks after finish painting and ceiling finishing operations are complete.

B. Install track level and hangers plumb and securely anchor to the ceiling to form a rigid installation.

C. Anchor surface mounted curtain tracks directly to exposed grid of lay in acoustical tile ceilings with suitable fasteners, spaced approximately 600 mm (24 inches) on center.

D. Anchor surface mounted curtain tracks to concrete, plaster and gypsum board ceilings with a minimum of 3 mm (1/8 inch) diameter fastenings or concealed clips spaced not more than 900 mm (three feet) on center.

E. Install suspended track seven feet, three inches above the finished floor, with hangers spaced no more than four feet on center. At ceiling line, provide flange fittings secured to hangers with set screws. Secure track to walls with flanged fittings and to hangers with special fittings.

F. Securely fasten end stop caps to prevent their being forced out by the striking weight of carriers.

G. Remove damaged or defective components and replace with new components or repair to the original condition.

3.2 ACCEPTANCE

A. Track shall be installed neat, rigid, plumb, level and true, and securely anchored to the overhead construction

B. Carrier units shall operate smoothly and easily over the full range of travel.

END OF SECTION 10 21 23

SECTION 10 2 600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Stainless Steel Corner guards.

B. Related Sections:

   1. Section 09 78 13 - "Metal Interior Wall Panels" for metal interior wall panels at bumper locations.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

C. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.

   1. Include similar Samples of accent strips and accessories involving color selection.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period materials are stored.
2. Store wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

    a. Store wall-guard covers in a horizontal position.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Structural failures.
    b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WALL GUARDS

A. Surface-Mounted, Metal Corner Guards #1: Fabricated from one-piece, formed or extruded metal with formed edges; with 90-degree turn to match wall condition, edges shall have an 11° taper.

1. Material: Stainless steel, Type 304.
    a. Thickness: Minimum 0.0500 inch.
    b. Finish: Directional satin, No. 4.
2. Wing Size: Nominal 3 by 3 inches.
3. Corner Radius: 1/8 inch
4. Length: Guards shall extend from top of base trim to bottom of ceiling, typical all locations.
5. Mounting: Adhesive.
    a. Heavy duty construction or rubber-based adhesive in accordance with manufacturer’s written recommendations
6. Edges shall be finished with color-matched caulk.
7. U-Shaped end caps shall be fabricated from one sheet of stainless steel.

2.2 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

D. Corner guards shall be fabricated to be free of sharp burrs and edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, scratches or other defects that might be visible in the finished Work.

1. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.
b. Adjust end caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Childcare accessories.
3. Under Lavatory guards.
4. Custodial accessories.

B. Related Sections:

1. Section 09 22 16 - "Non-Structural Metal Framing" for blocking and strap required for mounting accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.6 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 SUBSTITUTIONS

A. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser [D]:

1. Basis-of-Design Product: TORK; B-56TR; Surface-mounted Twin Jumbo Toilet Tissue Roll Dispenser.
2. Description: Double-roll dispenser.
3. Mounting: Surface mounted.
4. Capacity: Designed for jumbo tissue rolls.
5. Material and Finish: Plastic, Smoke Finish.

B. Paper Towel (Roll) Dispenser [H]:

1. Basis-of-Design Product: TORK; 83TR.
2. Description: Lever-actuated mechanism permits controlled delivery of paper rolls in preset lengths per stroke.
3. Mounting: Surface mounted.
4. Minimum Capacity: 8-inch-wide, 800-foot-long roll.
5. Material and Finish: ABS plastic, gray.
6. Lockset: Tumbler type.

C. Liquid-Soap Dispenser [F]:

1. Basis-of-Design Product: Purell CS4.
2. Description: Designed for dispensing soap.
3. Mounting: Surface mounted.

D. Grab Bar [A]:

1. Basis-of-Design Product: Bobrick; B-5806.99x36.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: Straight, 36 inches long.

E. Grab Bar [B]:

1. Basis-of-Design Product: Bobrick; B-5806.99x42.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches.

5. Configuration and Length: Straight, 42 inches long.

F. Grab Bar [C]:

1. Basis-of-Design Product: Bobrick; B-5806.99x18.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: Straight, 18 inches long.

G. Mirror Unit [K]:

1. Basis-of-Design Product: Bobrick; B165 1836.
2. Frame: Stainless-steel channel.

    a. Corners: Welded and ground smooth.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
    b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

2.4 CHILDCARE ACCESSORIES

A. Diaper-Changing Station [I]:

1. Basis-of-Design Product: Bobrick; KB110-SSWM.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

    a. Engineered to support a minimum of 250-lb static load when opened.

3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Stainless steel, No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners.
6. Liner Dispenser: Built in.

2.5 UNDERLAVATORY GUARDS

A. Under Lavatory Guard [N]:

1. Basis-of-Design Product: Truebro; Lav Guard 2.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
   a. Contractor furnished portable fire extinguishers.

B. Related Requirements:
1. Section 07 92 00 – “Joint Sealants” for perimeter caulking around cabinets.
2. Section 09 22 16 - "Non-Structural Metal Framing" for framing required rough openings for mounting fire protection cabinets in metal stud walls.
3. Section 09 29 00 - “Gypsum Board” for finishing surfaces surrounding fire protection cabinets.
4. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semi recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 FIRE EXTINGUISHER CABINET- FEC-1

A. Cabinet Type: Suitable for fire extinguisher device.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Basis-of-Design Product: Subject to compliance with requirements, provide Larsen's Manufacturing Company; AL2409-6R Semi-Recessed cabinet.
   b. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Aluminum sheet.

D. Semi recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/2-inch backbend depth.

E. Cabinet Trim Material: Aluminum sheet.

1. Thickness: .040"

F. Door Material: ½" thick Aluminum sheet.

G. Door Style: Vertical Duo glazed panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide keyed steel cam lock.
3. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Materials:

1. Aluminum: ASTM B 221, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 for extruded shapes.

   a. Finish: Clear anodic.

2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire extinguisher cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:

1. Fire-Extinguisher Cabinets: 54 inches above finished floor to top of cabinet.

B. Fire Extinguisher Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semi recessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-extinguisher cabinets, square and plumb.
4. Caulk joint where frame meets wall (gypsum board &/or CMU) around entire cabinet perimeter.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:
   1. Section 10 44 13 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. JL Industries, Inc.; a division of the Activar Construction Products Group.
      b. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
      c. Larsens Manufacturing Company.
      d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.
   2. Valves: Manufacturer’s standard.
   3. Handles and Levers: Manufacturer’s standard.
   4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type: UL-rated 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 11 31 00 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cooking appliances.
2. Refrigeration appliances.
3. Cleaning appliances.

B. Related Requirements:

1. Section 06 41 16 - “Plastic-Laminate-Faced Architectural Cabinets” for coordination with appliances in cabinets.
2. Section 26 05 03 - “Equipment Wiring Connections” for installing residential appliance in cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.

B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain residential appliances from single source and each type of residential appliance from single manufacturer.

C. Regulatory Requirements: Comply with the following:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with ICC/ANSI A117.1.

1.7 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Microwave Oven: Full warranty including parts and labor for on-site service on the magnetron tube.

1. Warranty Period: Five years from date of Substantial Completion.

C. Refrigerator/Freezer, Sealed System: Full warranty including parts and labor for on-site service on the product.

1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.
2. Warranty Period for Other Components: Two years from date of Substantial Completion.

D. Clothes Washer: Full warranty including parts and labor for on-site service on the product.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 RANGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

1. General Electric Company (GE Appliances).
2. LG Electronics.
3. Sears Brands LLC (Kenmore).
4. Whirlpool Corporation.

C. Electric Range: Drop-in range with one oven(s) and complying with AHAM ER-1.

1. Basis-of-Design Product: General Electric JD630DF Drop-in Electric Range with filler strip.
2. Width: 30 inches.

3. Cooktop Burner Type: Radiant; Smoothtop
4. Cooktop Surface: Overhanging Cooktop; White Patterned Ceramic Glass
5. Electric Burner Elements: Four.

    a. Type: Two 8-inch 2000 W element; One 6-inch 1200 W element; one 9/6 inch 3000 W Power Boil element.
    b. Controls: Located on front of rangetop.

6. Oven Features:

    a. Capacity: 4.4 cu. ft..
    b. Operation: Baking and self-cleaning.
    c. Broiler: Located in top of oven.
    d. Oven Rack(s): 2 Oven Racks; 7 Rack Positions
    e. Oven Door(s): Counterbalanced, removable, with observation window handle.
    f. Controls: Digital panel controls and timer display, located on front of rangetop.

7. Anti-Tip Device: Manufacturer's standard.
8. Electric Power Supply: As indicated on Drawings.
9. Material: Porcelain-enameled steel with manufacturer's standard cooktop.

    a. Color/Finish: White.

2.2 MICROWAVE OVENS

A. Microwave Oven:

1. Basis-of-Design Product: General Electric 1.1 cu. ft. Capacity Countertop Microwave Oven JES1145DLWW.
2. Mounting: Countertop.
3. Type: Conventional.
4. Dimensions:

    a. Depth: 16 inches.
    b. Height: 18 inches.

5. Capacity: 1.1 cu. ft.
6. Oven Door: Door with observation window.
7. Microwave Power Rating: Manufacturer's standard.
8. Electric Power Supply: As indicated on Drawings.
9. Controls: Digital panel controls and timer display.
10. Other Features: Glass Turntable.
11. Color: White.

2.3 UNDER CABINET HOOD

A. Under-the-Cabinet Hood

1. Basis-of-Design Product: General Electric 30” Under-the-Cabinet Hood Model# JVX3300DJWW w/filler strip.
2. Control Location: Front – Also provide in-wall backsplash mounted control switch for ADAAG Compliance.
3. Exhaust: Recirculating
4. Color: White

5. Cooktop Lighting: Incandescent
6. Ducting: Vertical: 7” Round
7. Fan Speed Control: 2-Speed
8. Filter Cleaning: Dishwasher Safe
9. Light Controls: On/Off
10. Removable Grease Filter(s): Yes
11. CFM/Sones Rating: 130/5.0 (Low Speed); 200/6.5 (High Speed)
12. Power Cord Kit: Yes

2.4 REFRIGERATOR/FREEZERS

A. Refrigerator/Freezer: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1 at Staff Lounge A110, PTA Kitchen B109, Workroom C130, and Workroom C229.

1. Basis-of-Design Product: GE Model # GTS22KGNRWW 21.9 cu. ft. Top Freezer Refrigerator.
2. Type: Freestanding.
3. Dimensions:

    a. Width: 33.75 inches.
    b. Depth: 34.5 inches.
    c. Height: 66.375 inches.

4. Storage Capacity:

    a. Refrigeration Compartment Volume: 15.25 cu. ft.
    b. Freezer Volume: 6.68 cu. ft.

5. Refrigerator Features:

    a. Interior light in refrigeration compartment.
    b. Compartment Storage: vegetable crisper and meat compartment.
    c. Door Storage: Modular compartments.

6. Freezer Features: One freezer compartment(s) with door(s).

    a. Automatic defrost.
    b. Interior light in freezer compartment.
    c. Automatic icemaker and storage bin.

7. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
8. Front Panel(s): Manufacturer's standard.
9. Upfront dual temperature controls
10. Appliance Color/Finish: White.

2.5 UNDERCOUNTER REFRIGERATORS

A. Undercounter Refrigerator with Ice Maker at Clinic A103.

1. Basis-of-Design Product: U-LINE CO29FW-00A-ADA Combo Model - Right-Hand Hinge
2. Type: Built-in
3. Dimensions:

a. Width: 20 7/8”
b. Height: 28 ½”
c. Depth: 23”

4. Refrigerator volume of 2.13 cu. ft.
5. Produces and stores up to 8 lbs. of ice per day.
6. No drain required.
7. Two removable tempered glass shelves.
8. Two fixed storage compartments in door.
9. Color: White

2.6 CLOTHES WASHER/DRYER COMBINATION

A. Clothes Washer/Dryer Combination: Complying with ASSE 1007.

1. Basis-of-Design Product: GE Unitized Spacemaker GUD27EESN. Electric Laundry Center.
2. Type: Freestanding washer/dryer unit with dual-drum design and electric dryer.
3. Dimensions:

a. Width: 26-3/4 inches.
b. Depth: 30-7/8 inches.
c. Height: 75-7/8 inches.

4. Washer and Dryer Drums: Perforated stainless steel.

a. Washer-Drum Capacity: 3.9 cu. ft.
b. Dryer-Drum Capacity: 5.9 cu. ft.

5. Washer Controls: Touch-pad controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
6. Dryer Controls: Touch-pad controls for drying cycle, temperatures, and fabric selectors.

a. Wash Cycles: Eleven wash cycles including regular, delicate, and permanent press.
b. Wash Temperatures: Six settings.
c. Speed Combinations: Two.

7. Electric Washer/Dryer Power: As indicated on Drawings.
8. Motor: Manufacturer's standard with built-in overload protector.
9. Washing Features:

a. Unbalanced-load compensator.
b. Inlet Hoses: Minimum length 60 inches.
c. Drain Hoses: Minimum length 48 inches.
d. Self-leveling legs.
e. Automatic dispenser for bleach, fabric softener, and detergent.
f. Spin-cycle safety switch.

10. Drying Features:

a. Removable lint filter.
b. Electronic temperature and moisture level sensor control.
c. End-of-cycle signal.
d. Interior drum light.

11. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
12. Water-Efficient Clothes Washer: Provide clothes washer with modified energy factor greater than or equal to 2.0 and water factor less than 5.5.
13. Appliance Finish: Porcelain enamel on top and lid; baked enamel on front and sides.

    a. Color: White.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 SUBSTITUTIONS

A. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where microwave ovens with vented exhaust fans will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

D. Utilities: Comply with plumbing and electrical requirements.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 11 31 00

SECTION 12 36 61 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid-surfacing-material countertop w/integral sink
3. Solid surface material backsplashes.
4. Solid surface material end splashes.
5. Solid surface material apron fronts.
6. Solid surface material sinks.
7. Solid surface windowsills and wall caps.

B. Related Requirements:

1. Section 22 09 00 - "Plumbing Fixtures and Trim" for non-integral sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

1.3 INFORMATIONAL SUBMITTALS

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as indicated on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Formica Solid Surfacing, or comparable products by one of the following:

    a. DuPont Corian
    b. Wilsonart Solid Surface
    c. Formica Traditions
        1) Color (countertops, sills, wall caps etc.): Formica #607 Ashen Concrete
    d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Integral Sink Bowls (Classrooms): Comply with CSA B45.5/IAPMO Z124.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart AV 1513, or comparable products by one of the following:

        1) DuPont Corian
        2) Formica Traditions
        3) Color:
            a) Integral Sinks: Designer White
        4) Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Countertops:

1. 1/2-inch- thick, solid surface material with front edge built up with same material.

C. Backsplashes: 1/2-inch- thick, solid surface material.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.
3. Fabricate countertops and backsplashes to dimensions, profiles, and details indicated.
4. Ease edges to radius indicated for the following:

a. Corners and Edges of solid surfacing: 1/16 inch.

E. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Drill holes in countertops for faucet and bubbler in the field per the Drawings.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 - "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

1. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 - "Joint Sealants."

I. Finish wood cleats or supports beneath countertops with a coat of clear varnish.

END OF SECTION 12 36 61

Technical Specifications
Volume 2

Libby Booth Elementary School Tenant Improvements

100% Construction Document
August 28, 2026

H+K ARCHITECTS

50 Washington St, Suite 200
Reno, Nevada 89503

P: 775+332+6640
www.hkarchitects.com

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NOT USED

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NOT USED

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SECTION 22 00 00 - PLUMBING

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and Section 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

B. This specification section lists general requirements for plumbing work and is hereby made a part of each Division 22 specification section.

C. For convenience or reference the Specifications are separated into Divisions and Sections. Such separations shall not operate to make the Engineer an arbitrator to establish subcontract limits between the Prime Contractor and his Subcontractors. In any case, the Prime Contractor is responsible to the owner for a complete project.

D. Wherever the word ‘provide’ is utilized with regard to materials or equipment on the drawings or in the specifications it shall be interpreted to mean ‘furnish and install’.

E. The term ‘exposed’ shall be interpreted to mean any equipment, ductwork, or piping that is not concealed above a continuous ceiling or inside a finished wall.

1.2 WORK INCLUDED

A. This section consists of general requirements and standard specifications covering certain parts of the plumbing work and is supplemented by other Division 22 specification sections covering additional work, requirements, and materials specifically applicable to the plumbing work of each section. Requirements of subsequent sections of the specifications, if in conflict with these general requirements, shall govern.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Provide work and materials in full accordance with the latest rules and regulations of the following:

2024 International Building Code
2024 International Existing Building Code (when applicable)
2024 Uniform Mechanical Code
2024 Uniform Plumbing Code
2024 International Energy Conservation Code
2023 National Electrical Code
2024 International Fire Code
2024 NFPA Codes and Standards
2024 Northern Nevada Code Amendments
Nevada State Fire Marshal
Nevada Occupational Safety and Health
Underwriters Laboratories
All other applicable state codes, rules, and regulations

B. Nothing in the drawings or specifications shall be construed to permit work not conforming to the listed codes and regulations.

C. In the event of an inconsistency between or within the plans, specifications, any of the contract documents, codes, or regulations, the better quality, higher cost, and/or greater quantity of materials and work shall be provided at no additional cost to the Owner.

1.4 FEES, PERMITS, AND UTILITY SERVICES

A. Obtain and pay for all permits and service required for installation of this work; arrange for required inspections and secure approvals from the authorities having jurisdiction.

B. Arrange for utility connections and coordinate work with utility company.

C. Arrange required inspections and secure approvals from the authorities having jurisdiction.

1.5 SITE EXAMINATION

A. Examine site, verify dimensions and locations against drawings, and inform self of conditions under which work is to be done before submitting proposal. No allowance will be made for extra expense on account of error.

B. Information shown relative to existing services is based upon available records and data but is approximate only. Make minor deviations found necessary to conform with actual locations and conditions without extra cost. Verify location and elevation of utilities prior to commencement of excavation for new piping or its installation.

1.6 PLACEMENT OF EQUIPMENT AND WORK

A. The placement of equipment and mechanical work in the locations and spaces shown on the drawings is the Contractor's responsibility.

B. Move equipment and/or work into spaces through openings provided or located in the spaces during construction, as required.

C. Perform disassembling and reassembling of equipment or other work necessary to accomplish this requirement without extra cost to the Owner.

1.7 SUBMITTALS AND SUBSTITUTIONS

A. Submit to the Architect/Engineer for review, within a reasonable time after award of Contract and in ample time to avoid delay of construction, shop drawings or submittals on all items of equipment and materials, including all substitutions. Substitutions will be interpreted to be all manufacturers other than those specifically listed by model or catalog number. Also see Division 1 for additional related requirements.

B. Partial or incomplete sets of equipment and materials submittals will not be acceptable.

C. Only one request for substitution will be considered on each item of equipment or material. No substitutions will be considered thereafter.

D. Quantities are the Contractor’s responsibility and will not be reviewed.

E. All submittal data shall be tailored to suit the specific project, with appropriate model or part numbers, materials, sizes, options, and accessories clearly indicated for each different submittal item and on each submittal page. Submittal pages without this information will be returned and will need to be resubmitted with all of the required information indicated on each sheet.

F. The Contractor shall certify that he has examined all submittal data and that the equipment and materials submitted for review meet or exceed the requirements of the drawings and specifications. Submittals without the required certification will not be acceptable.

G. Electronic Formatted Submittals
   1. Provide submittals in electronic form (.pdf file format).
   2. Identify and incorporate submitted information, including a cover sheet, and the following:
      a. Project Name
      b. Submittal Package Number (with revision number identified)
      c. Date
      d. Name of Architect/Engineer
      e. Name of Contractor
      f. Name of Subcontractor
   3. Group submitted items by specification section, and provide the following:
      a. Index of submitted products with page numbers
      b. Name of Firm or entity that prepared submittal
      c. Name of Supplier
      d. Name of Manufacturer
      e. Equipment and/or fixture tag, if applicable
      f. Number and title of appropriate specification section
   4. Items indicated by the Architect/Engineer to be resubmitted shall be resubmitted as follows:
      a. Retain items marked as 'No Exceptions Taken' or 'Make Corrections Noted' and resubmit with the revised package. Do not provide new sheets for these items.
      b. Provide revised submittal sheets for all other reviewed items.
      c. Provide originally submitted sheet with Architect/Engineer comments.
      d. Clearly indicate amendments and modifications made in response to previous submittal review comments.

H. If the Contractor desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified. No substitutions will be allowed unless requested and reviewed in writing. The Architect/Engineer will review and take appropriate action on shop drawings, product data, samples, and other submittals as required by the contract documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the contract documents. The review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Architect/Engineer shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the Contractor, nor shall the Architect/Engineer be required to review partial submissions or those for which submissions for correlated items have not been received. The Architect/Engineer reserves the right to require the originally specified item.

I. Installation of reviewed substitutions is the Contractor's responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the Owner. Review by the Architect/Engineer of the substituted equipment and/or the dimensioned drawings does not waive the requirements stated herein.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Mention herein or on the drawings requires that the Contractor provide each item listed of quality noted or equal. All material shall be new, full weight, standard in all respects, and in first class condition. Provide materials of the same brand or manufacturer throughout for each class of material or equipment wherever possible. Materials shall be tested within the continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements.

B. The grade or quality of materials desired is indicated by the trade names or catalog numbers stated herein.

C. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without permission of the Architect/Engineer.

D. Provide factory-fabricated piping specialties and valves recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Contractor to comply with installation requirements. Provide sizes and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Contractor's option.

E. Unless otherwise indicated, provide valves of same size as upstream pipe size.

F. All equipment shall comply with the mandatory equipment efficiencies listed in International Energy Conservation Code Section C403.3.2.

G. No material installed as part of this work shall contain asbestos in any form.

2.2 MATERIALS FURNISHED

A. Identify all materials and equipment by the manufacturer's name and model number. Remove any unidentified materials and equipment from the site.

B. Equipment scheduled and/or specified by the manufacturer's model number shall include all accessories, controls, etc. listed in the catalog as standard with the equipment. Furnish optional or additional accessories as scheduled and/or specified.

C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged, and shall be replaced with new equipment. Variance from this requirement is permitted only with written consent of the Architect/Engineer.

D. Provide an authorized representative to constantly supervise the work of this division. Check all materials prior to installation for conformance with the drawings and specifications.

PART 3 - EXECUTION

3.1 ACCESS TO PLUMBING WORK

A. Comply with manufacturer's instructions for installation of access doors.

B. Access panels shall be furnished and installed wherever valves, balance valves, damper operating mechanisms, air terminal units, fans, and similar items normally requiring adjustment or servicing are installed in concealed or inaccessible spaces. Coordinate with access doors shown on architectural drawings.

C. Continuously check architectural drawings for clearance and accessibility of equipment specified herein to be placed. No allowance of any kind will be made for negligence on the part of the Contractor to foresee means of installing his equipment into proper position.

3.2 DRAWINGS AND COORDINATION

A. General arrangement and location of piping, ductwork, equipment, etc. are shown on the drawings or herein specified. Carefully examine other work that may conflict with this work. Install this work in harmony with other crafts and at proper time to avoid delay of work.

B. In advance of construction, work out minor changes and relocations to suit actual conditions and work of other trades to avoid conflict therewith. This effort shall not be cause for additional cost.

C. Verify all measurements at the building and be responsible for the correctness of same. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the drawings.

D. In addition, obtain all necessary information from the other trades regarding centers of partitions, walls, location of plumbing mains, fire sprinkler mains, and electrical conduits, ducts, pipes, etc. in order that pipes, equipment, and ductwork may be placed in their correct positions.

E. Execute any work or apparatus shown on the drawings and not mentioned in the specifications, or vice versa, the same as if specifically mentioned by both. Omission from drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve the Contractor of furnishing same in place complete.

F. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.

G. Furnish materials and work at proper time to avoid delay of the work.

3.3 AS-BUILT DRAWINGS

A. Upon completion of work submit to the Architect/Engineer as-built drawings showing all changes in equipment, piping, ductwork, etc. installed as part of this project which are not in accordance with the contract drawings. As-built drawing deliverables shall be in accordance with the requirements of Division 1, and shall consist of the following as a minimum.

1. Provide as-built drawings in electronic file format (pdf file). In addition to the electronic file, when field mark-ups have been utilized, provide a complete set of full size neatly and legibly marked as-built drawings on 20 pound white bond paper.
2. As-built drawings shall be full size (same size as the contract documents) and shall be standard engineering scale. The minimum drawing scale shall match those provided in the contract documents.
3. As-built drawings shall include all outside utility connections, piping, etc. installed under this Contract. Locate and dimension all work with reference to permanent landmarks.

B. Match all symbols and designations used in the contract drawings when preparing the as-built drawings.

C. Indicate clearly and correctly all work installed differently from that shown, and maintain records up to date as work progresses. Include invert elevations of pipes below grade of floor, the floor lines, plugged wyes, tees, caps, exact locations and sizing of piping, location of valves, and the like. Dimension locations from structural points.

D. Properly identify all stubs for future connections as to locations and use by setting of concrete markers at finished grade in manner suitable to the Architect/Engineer.

3.4 PROJECT MODIFICATIONS

A. During the progress of construction, if any conditions arise that necessitate revisions, modifications, or relocation of any plumbing equipment or materials, such revisions shall be immediately brought to the attention of the Architect/Engineer. The Contractor shall then prepare necessary drawings showing the proposed changes. All proposed changes shall be submitted, reviewed, and approved by the Architect/Engineer prior to proceeding with any associated revision work in the field.

B. Maintain copies of all approved changes at the project site for reference by all parties during the remaining work.

C. Incorporate all revisions into the as-built drawings.

3.5 CLOSING IN OF UNINSPECTED WORK

A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected and tested. Should work be enclosed or covered up before it has been inspected and tested, uncover work at own expense. After it has been inspected and tested, make repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.6 FORMING, CUTTING AND PATCHING

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this Contractor fails to coordinate with other contractors at proper time or fails to locate items properly, resulting in extra work, then this Contractor is responsible.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for work.

3.7 EXISTING SERVICES

A. Provide and install all required connections to existing systems as required by the drawings and specifications.

B. Integrate existing systems with all new work to provide a complete working system.

C. Provide minimum 48 hour notice to Owner of any service interruptions. All service interruptions shall be kept to the minimum possible time. When requested by Owner service interruptions shall occur outside of normal working hours.

D. The Contractor shall be responsible for damage to any part of the premises during the guarantee period that is caused by defects, leaks, or breaks in work furnished and/or installed under this section.

E. The Contractor shall replace refrigerant, lubricants, and/or gases lost as a result of defects, breaks, or leaks in the work.

3.8 PROJECT COMPLETION TESTS AND START-UP

A. Upon completion of the plumbing work, or at such time prior to completion as may be determined by the Architect/Engineer, operate and test all plumbing equipment and systems for a period of at least three consecutive 8 hour days to demonstrate the satisfactory overall operation of the building or project as a complete unit. Commence tests after preliminary balancing and adjustments to equipment have been checked. Notify the Architect/Engineer at least seven calendar days in advance of starting the required tests.

B. Provide training and orientation of Owner’s operating staff in proper care and operation of all plumbing equipment, systems, and controls.

C. Neatly tabulate and deliver to the Architect/Engineer complete operational data. The Architect/Engineer reserves the right to spot check results, and if discrepancies or errors are noted, the Contractor will be required to redo balancing tests and tabulations entirely.

D. During the test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in a first class operating condition.

E. Mark final positions of balancing valves after balancing is complete.

F. Final observation will not be conducted until all of the above requirements have been completed and the balance report has been submitted and reviewed.

3.9 WARRANTY/GUARANTEE

A. The Contractor shall be responsible for all work done and material installed under the plans and specifications. Repair or replace, as may be necessary, any defective work, material, or part which may show itself within one year of filing of the Notice of Substantial Completion and be responsible for damage to other materials, furnishings, equipment, or premises caused by such defects during this period, if in the opinion of the Architect/Engineer said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to the Owner.

B. The Contractor shall be responsible for damage to any part of the premises during the guarantee period that is caused by defects, leaks, or breaks in work furnished and/or installed under this section.

3.10 ELEVEN MONTH WARRANTY INSPECTION

A. Prior to the end of the one year warranty period (approximately 11 months after the date of the Certificate of Substantial Completion and prior to the one year warranty end date) the Contractor shall schedule a date with the Owner and the Engineer to conduct a thorough review of the plumbing systems and equipment, and provide follow-up operating and maintenance re-training (where requested by the Owner). All major Subcontractors associated with the plumbing work shall attend the operating and maintenance re-training and warranty inspection sessions. The Contractor shall video any follow-up operating and maintenance re-training that is requested by the Owner and provide electronic copies to the Owner and the Engineer. The Contractor shall take immediate action to remedy any warranty items identified during the warranty inspection, at no cost to the Owner. Provide a minimum of 14 days advance notice of the proposed date for the warranty inspection and operating and maintenance re-training sessions.

3.11 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 05 00 - BASIC MATERIALS AND METHODS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 220000 (Plumbing) is hereby made a part of this section.

B. This section provides requirements for basic materials and methods related to all of the Plumbing work. This section applies to all other Division 22 specification sections.

1.2 WORK INCLUDED

A. Types of Plumbing related work specified in this section include the following:

1. General Materials
2. Hangers and Supports for Plumbing Systems
3. Seismic Bracing for Plumbing Systems
4. Valves
5. Valve Boxes
6. Access Doors and Panels
7. Roof and Wall Flashings
8. Unions and Flanges
9. Cathodic Protection
10. Thermometers
11. Pressure Gauges
12. Pipe Escutcheons
13. Pipe Sleeves
14. Pipe Sleeves with Mechanical Sleeve Seals
15. Strainers
16. Flow Meters
17. Penetrations in Fire and Smoke Rated Partitions
18. Pipe Anchors and Guides
19. Flexible Hose Expansion Loops
20. Piping and Equipment Identification
21. Tracer Wire and Warning Tape for Below Ground Piping
22. Painting
23. Concrete Work
24. Electric Motors
25. Electric Motor Starters

1.3 PROJECT CONDITIONS

A. Existing Utilities: Locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of valves and piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Valve Types: Provide valves of same type by the same manufacturer.

C. Identification: Provide valves and piping specialties with the manufacturer's name or trademark and pressure rating clearly marked on the valve body.

1.5 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each type of manufactured valve and piping specialty. Include pressure drop curve or chart for each type and size of isolation valve, balancing valve, and control valve.

B. Operation and Maintenance Data: Submit operation and maintenance data and spare parts lists for each type of manufactured valve and piping specialty. Include this data and product data in the operating and maintenance manual in accordance with all associated requirements.

C. All interface requirements (BACnet or other) shall be coordinated with the temperature control system subcontractor prior to issuing submittals and/or ordering any equipment that is required to have an interface.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

A. Provide factory-fabricated valves and piping specialties as recommended by the manufacturer for use in the service indicated. All valves, fittings and accessories installed in potable water systems shall be rated for such use. Provide piping specialties of types and with pressure ratings indicated for each type of service, or if not indicated, provide proper selection as determined by the Contractor to comply with the installation requirements. Provide sizes and connections which properly mate with piping, tubing, and equipment connections.

B. Unless otherwise indicated, provide valves of the same size as the upstream pipe size.

C. All valves, fittings, and accessories located in potable water systems shall be constructed of appropriate materials and conform to the requirements of NSF/ANSI Standards 61 and 372.

2.2 HANGERS AND SUPPORTS FOR PLUMBING SYSTEMS

A. See Specification Section 220530 (Hangers and Supports for Plumbing Systems).

2.3 SEISMIC BRACING FOR PLUMBING SYSTEMS

A. See Specification Section 220540 (Seismic Bracing for Plumbing Systems).

2.4 VALVES

A. See Specification Section 220510 (Valves for Plumbing Systems).

2.5 VALVE BOXES

A. Provide at each valve in ground a concrete valve box with the cover marked for the applicable service. Furnish an extension handle for valves as required for opening and closing the valve. In areas that are not subject to vehicle traffic concrete valve boxes shall be Christy Model B-09, or approved equal, with a steel checker plate cover. In areas that are subject to vehicle traffic concrete valve boxes shall be Christy Model B-1017, or approved equal, with a steel checker plate cover.

1. Do not locate valve boxes in areas subject to vehicle traffic, in walkways, or in covered passageways unless absolutely necessary.
2. Provide valve box extensions as required to set the bottom of the valve box tight on top of the piping in which the valve is installed.
3. Provide special valve boxes where required to conform to local codes.

2.6 ACCESS DOORS AND PANELS

A. Where floors, walls, or ceilings must be penetrated for access to plumbing equipment, provide access doors with 14 inch by 14 inch minimum usable opening. Where entry of service personnel may be required, provide a 22 inch by 30 inch minimum usable opening.

B. Access doors shall match those shown on the architectural plans or in the architectural specifications (typically in Division 8) unless noted otherwise herein.

C. Where specific information or details relating to access panels different from the above is shown or given on the drawings or in other divisions of work, then that information shall supersede this specification.

D. Where access panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

E. Provide insulated access doors where located in internally insulated ducts or casings.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering access doors which may be incorporated in the work include Milcor, Best, or approved equal:

Milcor Style M	Drywall and/or Masonry
Milcor Style K	Plaster
Milcor Style UFR	Fire Rated (where required)

2.7 ROOF AND WALL FLASHINGS

A. Flashing for penetrations of the roof for plumbing items such as pipes and flues shall be as indicated on the drawings and in these specifications. Where exterior sheet metal flashings are indicated on the drawings or details, the flashings shall be galvanized sheet metal. The work of this section shall include layout, sizing, and coordination of roof and wall penetrations with all trades. Flues shall have a minimum 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.

B. Sewer vents and other plumbing piping terminating above a non-membrane type roof shall have a metal roof flashing and counter-flashing manufactured by Oatey, Stoneman, or approved equal.

2.8 UNIONS AND FLANGES

A. Furnish and install unions at each threaded or soldered connection to all equipment, tanks, etc. Unions shall be in accordance with the following listing:

Type of Pipe	Union
Threaded steel 2" and smaller	150 lb threaded malleable ground joint, brass to iron seat, black for black piping, galvanized for galvanized piping.
Threaded steel 2-1/2" and larger	125 lb cast iron threaded flanged union, flat faced, gasket, black for black piping, galvanized for galvanized piping.
Copper tubing 2" and smaller	150 lb bronze ground joint, bronze to bronze sweat connection.
Copper tubing 2-1/2" and larger	150 lb cast bronze, flat faced flange with silver brazing threadless ends.

B. Insulating couplings or flanges shall be furnished and installed at all connections of piping with dissimilar materials. Construct couplings so that the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Heavily line the couplings with a hard, insulating, phenolic threaded coupling in standard pipe sizes.

C. Furnish and install flanges at each flanged connection to equipment, tanks, and valves per following schedule:

Type of Pipe	Flanges
Threaded steel pipe 2-1/2" and smaller	125 lb threaded cast iron, flat face flange, black or galvanized steel as applicable.
Welded steel pipe 2-1/2" and larger	150 lb welded forged steel, raised face flange.

D. Provide full faced or ring type gasket material to suit facing on flanges. Gasket material shall be 1/16" thick Garlock Blue-Gard, or approved equal. Gasket material shall be suitable for the connected piping system content and temperature.

2.9 CATHODIC PROTECTION

A. Furnish and install dielectric unions at all locations described herein, whether shown on drawings or not. Construct couplings and flanges so that the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Couplings shall be lined with a hard, insulating, phenolic plastic threaded in standard pipe sizes.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following, or approved equal:

Nibco
Legend
Zurn
Watts

2.10 THERMOMETERS

A. Thermometers shall be of the bimetal helix type, Miljoco Model B5098A, or approved equal by Weiss or Weksler. Thermometers shall be accurate to within plus or minus 1% throughout the entire scale range. Scales shall have a minimum of 2 degrees between graduations and a maximum of 20 degrees between figures.

B. Thermometers shall be 5 inch diameter with polycarbonate lens, stainless steel case and ring, stainless steel stem, and stainless steel well. Thermometer stem length for piping shall be 2-1/2 inches, and stem length for tanks shall be 9 inches. Thermometers installed on insulated tanks or piping shall be provided with an extension neck well to compensate for the thickness of the insulation.

C. Thermometer ranges shall be as listed below.

Location	Range
Cold water piping mains	25° to 125°F
Hot water piping mains	0° to 250°F

D. Thermometers shall include an adjustable bracket allowing rotation to any position, and shall be located such that they are easily read from a normal vantage point.

2.11 PRESSURE GAUGES

A. Pressure gauges shall be flangeless case type, Miljoco Model P4598L, or approved equal by Weiss or Weksler. Gauges shall be accurate to within plus or minus 1% throughout the entire scale range. Scales shall have a minimum of 2 degrees between graduations and a maximum of 20 degrees between figures.

B. Pressure gauges shall be 4-1/2 inch diameter with acrylic lens, stainless steel case, and stainless steel ring. Gauge movement shall be brass with precision-milled teeth. Gauges shall be selected with a pressure range such that the gauge reads near the middle of the total gauge range at the pressure indicated on the drawings.

2.12 PIPE ESCUTCHEONS

A. Provide chrome plated brass pipe escutcheons with inside diameter closely fitting pipe outside diameter or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, ceilings, or pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish and screw or spring clamping device with concealed hinge.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe escutcheons which may be incorporated in the work include the following, or approved equal:

Chicago Faucets
Pasco Specialty and Manufacturing
Sanitary Dash

2.13 PIPE SLEEVES

A. Where pipes pass through exterior walls above grade and/or through concrete floors install a Schedule 10 galvanized metal sleeve providing between a 1/2” and 1” clearance around the sides of the pipe. The pipe shall be covered with high density fiberglass insulation. Pipe insulation shall be 1/2” to 1” thick Johns Manville Microlok HP or Johns Manville Trymer 25-50 for the full thickness of the concrete. After the piping has been installed, the fiberglass insulation shall be cut away or compressed leaving a 1/2” deep space that shall then be filled with a high quality silicone sealant resulting in a flat, water-tight installation.

B. Where pipes pass through fire rated walls above grade or fire rated concrete floors install a Schedule 10 galvanized metal sleeve providing between a 1/2” and 1” clearance around the sides of the pipe and/or pipe insulation for the full thickness of the concrete. After the piping has been installed, fill the annular space with a 3M sealant in accordance with the applicable UL fire rating system.

2.14 PIPE SLEEVES WITH MECHANICAL SLEEVE SEALS

A. Provide mechanical sleeve seals for pipe sleeves located in foundation walls below grade and/or in exterior walls below grade as follows:

1. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing a water-tight seal.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe sleeves with sleeve seals which may be incorporated in the work include the following, or approved equal:

Thunderline Link-Seal
Calpico

2.15 STRAINERS

A. Provide wye strainers as indicated on the drawings. Strainers shall be full line size of connecting piping, with ends matching the piping system materials, and with cast iron body. Select strainers for 125 psi working pressure, with stainless steel screens, and gasket seal. Provide hose end ball valve on the drain fitting.

B. Strainer screens shall have an open area equal to at least twice the cross-sectional area of the pipe in which they are installed (based on IPS) and may be either woven wire or perforated type. Strainer openings shall be .045 inch diameter perforations for strainers up to 3” size and .125 inch diameter perforations for strainer sizes 4” and larger.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering low pressure strainers which may be incorporated in the work include the following, or approved equal:

Zurn
Watts
Metraflex

2.16 FLOW METERS

A. Flow Meters for Domestic Water Make-Up: When shown on the drawings, provide ultrasonic style flow meters, Belimo Model FM100, or approved equal. Turbine type flow meters are not acceptable. Flow meters shall be installed in strict conformance with the manufacturer's installation instructions, including required straight pipe length upstream and downstream of the flow meter. Flow meters shall be certified under NSF/ANSI Standard 61 for use in a potable water system.

B. Flow Meters for Domestic Cold Water Mains (Monitored): When shown on the drawings, provide Seametrics Model iMag4700 electromagnetic flow meters. Turbine type flow meters are not acceptable. Flow meters shall be installed in strict conformance with the manufacturer's installation instructions, including required straight pipe length upstream and downstream of the flow meter. Flow meters shall be certified under NSF/ANSI Standard 61 for use in a potable water system. Water flow meters shall be interfaced with and monitored by the direct digital control system

C. Flow Meters for Domestic Cold Water Mains (Non-Monitored): When shown on the drawings, provide Seametrics Model MJNE brass body flow meter, with hall-effect sensing, or approved equal. Flow meters shall be certified under NSF/ANSI Standard 61 for use in a potable water system.

2.17 PENETRATIONS IN FIRE AND SMOKE RATED PARTITIONS

A. Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe, conduit, and duct penetrations. Seal all penetrations with fire-stop and smoke-stop materials complying with the requirements for firestopping and fill materials specified in this section.

B. Schedule and conduct a firestopping pre-installation conference at the job site. Coordinate all firestopping means and methods with other contractors and the general contractor (when applicable) prior to beginning any work.

C. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 (Approval of Firestop Contractors), or been evaluated by UL and found to comply with their 'Qualified Firestop Contractor Program Requirements'.

D. Install all penetration firestopping systems to comply with the manufacturer's written installation instructions and published drawings for products and applications.

E. Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by the penetration firestopping system manufacturer or when substrates are wet because of rain, frost, condensation, or other causes.

F. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilation, or where this is inadequate, forced-air circulation.

G. The specified firestopping systems are based on a solid sealant only, or combinations of solid sealant, foam sealant, and refractory fibers of thickness required to attain hour ratings.

H. Systems shall comply with the following:
   1. Provide a flexible seal to prevent passage of fire, smoke, toxic gases, and water through openings, and prevent transmission of sound and vibration from the penetrating element to the structure.
   2. Provide hour ratings indicated and in accordance with ASTM E 814 and/or UL 1479.
   3. For projects located in the State of California comply with requirements of CBC Sections 709.6, 709.7, 709.8, 710.2, 710.3 and 710.6, and CBC Standards 7-1 and 7-5.

I. Acceptable Manufacturers: 3M, Hilti, Nelson, Specified Technologies, Tremco, Roxtec, or as otherwise specified. The established standard in most cases is 3M, unless otherwise specified. The listed products are specified to establish standards and the type of materials required. Materials shall be as specified, or approved equal.

J. Sealant: Select among the following materials as appropriate for the application.
   1. Solid (Elastomeric): 3M Fire Barrier Premium Latex CP 25WB+ Caulk, one-component elastomeric water-based latex sealant designed for use as a through-penetration firestop.
   2. Foam: 3M Fire Barrier 2001 Silicone RTV Foam, two-component silicone elastomer foam-in-place sealant designed to fill irregular or complex voids.
   3. Wrap Strip: 3M Fire Barrier FS-195+ Wrap Strip, fire resistive strip designed to be wrapped around the penetrating item and secured in place.
   4. Restricting Collar: 3M Fire Barrier RC-1 Restricting Collar, sheet metal, designed for use with wrap strip in combustible through-wall firestop penetration systems.
   5. Composite Sheet: 3M Fire Barrier CS-195+ Composite Sheet, elastomeric layer reinforced with mesh restraining wire and covered with aluminum foil on one side and bonded to sheet metal, forming a fire resistive sheet.
   6. Putty: 3M Fire Barrier MP Moldable Putty+ Pads and Sticks, one-component elastomeric formable putty, designed for use as a through-penetration firestop system.
   7. Spray: 3M FireDam Spray 100, flexible water-based coating.
   8. Primers: As recommended by the sealant manufacturer.

K. Pillows: Nelson PLW Firestop Pillow, Hilti FS Fire Block, dust proof chemical resistant cloth with heat-reactive expanding solidifying fill, designed for large openings that require frequent cable alterations.

L. Safing Insulation: USG Thermafiber Safing Insulation, 4 lb density mineral wool insulation, unless indicated otherwise.

2.18 PIPE ANCHORS AND GUIDES

A. Provide pipe anchors and guides as indicated on the drawings and/or as required to accommodate any thermal expansion, contraction, or seismic movement of the piping system. Pipe anchors and guides shall be Metraflex Model PGIV, or approved equal by Mason Industries.

2.19 FLEXIBLE HOSE EXPANSION LOOPS

A. Provide flexible hose expansion loop(s) as indicated on the drawings and/or as required to accommodate any thermal expansion, contraction, or seismic movement of the piping system. Flexible hose expansion loops shall be Metraloop as manufactured by Metraflex, or approved equal.

B. Flexible hose expansion loops shall be manufactured complete with two parallel sections of corrugated metal house, compatible braid, 180 degree return bend, with inlet and outlet connections. Field fabricated loops will not be acceptable.

C. Flexible loops shall be capable of 4 inches of movement in the ±X, ±Y, and ±Z planes.

D. Flexible hose expansion loops shall impart no thrust loads to system supports, anchors, or the building structure.

E. Flexible hose expansion loop return fittings shall be supported to allow movement.

F. Flexible loops for natural gas service shall be CSA/AGA certified.

G. All flexible hose expansion loops shall be manufactured in accordance with the documented manufacturer's weld procedure specifications.

H. The weld procedure qualification record shall be used to document the execution of the procedure and shall follow the general guidelines of ASME Section IX. Each welder shall conform to the in-house procedure qualification record and be qualified prior to each production lot. The testing of each individual welder shall be documented in a welding procedure qualification record.

I. Install loops and guides per the manufacturer's written installation instructions and the Mechanical Contractors Association of America 'Guidelines for Quality Piping Installations'.

2.20 PIPING AND EQUIPMENT IDENTIFICATION

A. Each piping system furnished and installed under this work shall be identified and the direction of flow indicated by means of colored labels and flow arrows, all as specified herein. The labels shall be applied after all painting, priming, and cleaning of the piping and insulation is completed.

B. Provide prefabricated coiled plastic piping labels as manufactured by Marking Services Incorporated (MSI), or approved equal. Labels shall comply with the most current edition of ANSI/ASME Standard A13.1 with regard to color, letter height, and marker size. The labels shall have black or white lettering and flow arrows on colored backgrounds and shall not require adhesive.

C. The label background colors shall conform to the color schedule in the 'Execution' section of this specification.

1. For pipe labels used indoors use coiled polyester labels, MSI Model MS-975, or equal.
2. For pipe labels used outdoors use coiled polyester labels, MSI Model MS-995, or equal.
3. For piping with an outside diameter, including insulation, greater than 6 inches provide the label manufacturer's nylon straps to secure label to piping. Labels shall lie smoothly against pipe or insulation completely around the pipe.
4. The size of the lettering and label shall be such that the lettering can be easily read from the floor and the colors shall be easily discernible.

D. Provide a white plastic lamacoid plate for each and every piece of equipment installed in this work. Lettering on plate shall be black, with size of lettering to suit equipment. Lettering shall be a minimum of 1/2 inch in height. Plates shall be riveted or bolted to equipment near electrical disconnect or control access panel.

E. Where mechanical or plumbing equipment requiring access is located above a ceiling or behind an access panel, provide an adhesive clear plastic label with 3/8" black lettering on the ceiling grid or access panel identifying the equipment.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the Work include the following, or approved equal:
Marking Services Incorporated (MSI)
LEM Products
Seton
Craftmark

2.21 TRACER WIRE AND WARNING TAPE FOR BELOW GROUND PIPING

A. Protect the following underground piping (when shown on the mechanical and/or plumbing drawings) with tracer wire and underground warning tape. Tracer wire shall be No. 14 AWG Pro-Trace Model HF-CCS-PE30, or approved equal. Warning tape shall be Seton Detectable Underground Warning Tape, or approved equal. Warning tape shall be a minimum of 5 mils thick with aluminum backing.

1. All non-metallic water, waste, and gas piping.

B. Jacket color and labeling shall be specifically matched to the piping below.

C. Tape shall be buried approximately one half of the pipe buried depth, and in strict accordance with the manufacturer's written installation instructions.

1. Tape buried up to 24" deep shall be a minimum of 4" wide.
2. Tape buried greater than 24" deep shall be a minimum of 6" wide.

D. The procedure for locating the installed tracer wire shall be demonstrated to the Owner and Engineer by the Contractor utilizing an appropriate locating device. Locating device shall be Ridgid 'Seetech', Ridgid 'Navitrack', or approved equal.

2.22 PAINTING

A. In general, painting will be done by others. Exposed piping and unfinished portions of equipment to be painted shall be cleaned by this Contractor of grease, oil, rust, or dirt in preparation for painting. Spot prime all factory primed surfaces as necessary to repair any damage to finish.

2.23 CONCRETE WORK

A. Where specifically indicated on the drawings or specified as part of the plumbing work, this Contractor shall furnish and install concrete work such as thrust blocks and/or spring isolator bases.

B. Concrete and reinforcing steel shall be equal to that specified for general construction.

C. Except as noted above, concrete work will be furnished and installed by others. This Contractor shall coordinate all requirements accordingly.

2.24 ELECTRIC MOTORS

A. Electric motors larger than 1/2 horsepower rating, unless otherwise noted, shall be ball bearing, open drip proof, squirrel cage, induction type, normal starting torque, 3 phase, 60 cycle service, 40°C continuous rating, and shall conform in all respects to latest applicable standards of NEMA and AIEE. Motors shall be Century, Louis Allis, Baldor, or equal. Motors located outdoors shall be TEFC type.

B. All motors 1 horsepower and above shall be high efficiency type, Century E-Plus, or approved equal.

C. Motors utilized with variable frequency drives shall be rated as inverter duty per NEMA standards.

D. Motors shall have nameplate voltage rating of operating voltage specified in subsequent sections of specifications or as shown on drawings and shall have a 1.15 service factor.

E. For normal applications, motors shall be furnished for normal starting torque duty. It shall be this Contractor's responsibility, however, to provide motors and starters (where starters are furnished under this section) having suitable starting torque and current characteristics to allow starting the equipment within the branch circuit protection provided and within the overload protection required by code.

F. Splash-proof or totally enclosed motors having a continuous duty temperature rise rating not exceeding 35°C shall have adequate starting torque, as recommended by the manufacturer, for the service intended.

G. All motors shall be rated at ±10% of the scheduled voltage. If not, provide each motor with a boost transformer sized for the intended use and installed in a rated enclosure.
   1. Boost transformers for equipment provided under the plumbing work shall be furnished by the plumbing contractor and turned over to the electrical contractor for installation, unless otherwise noted.

H. Shaft Grounding:
   1. All variable frequency drive motors less than 300 horsepower shall have a single shaft grounding system to protect the bearings from capacitive discharge through the bearings.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following, or approved equal:

      CR Series by Shaft Grounding Systems
      AEGIS SGR Conductive Microfiber Brush

2.25 ELECTRIC MOTOR STARTERS

A. Magnetic motor starters for equipment provided under the plumbing work shall be furnished by the plumbing contractor and turned over to the electrical contractor for installation, unless otherwise noted. All motor starters shall be by the same manufacturer, Westinghouse, Square D, Cutler-Hammer, General Electric, or approved equal.

B. Magnetic motor starters provided as part of motor control centers shall be provided and installed by the electrical contractor.

C. Submit schedule to the Architect/Engineer denoting the following:
   1. Designation of each motor
   2. Name plate rating of each motor
   3. Running current of each motor
   4. Catalog number and rating of starter overload elements
   5. Circuit breaker trip size (when in combination starter)

D. Unless otherwise noted, magnetic motor starters shall be furnished in a NEMA 1 enclosure for inside installation and in a gasketed NEMA 4 enclosure for outside installation, with three thermal overloads for three phase motors and one overload element for single phase motors. All overloads shall be ambient compensated.

E. Combination magnetic starters shall be Westinghouse Type A206 with circuit breaker disconnect and trip size of breaker as required for motor size, or as otherwise noted.

F. Magnetic motor starters shall be Westinghouse Type A200, or approved equal.

G. Manual motor starters shall be Westinghouse Type MST01 less enclosure, or approved equal.

H. Magnetic motor starters shall be provided with cover-mounted Hand-Off-Auto ‘Oil-Tight’ type switches as scheduled with integral fused 120 volt single phase control transformers.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Perform excavation required for installation of piping, service lines, and other work as indicated on the drawings. Verify location and elevation of all existing utilities prior to excavation for installation of new piping.

B. Excavations shall be of open vertical construction of sufficient width to provide free working space at both sides of the trench and around piping as required for joining, caulking, backfilling, and compacting.

C. Where invert elevations are not shown, dig trenches in accordance with the following:

Exterior Water Piping (36 inches minimum cover)
Gas Piping (18 inches minimum cover)

D. Dig trenches straight and true to line and grade with holes for bells for bell-and-spigot pipe. Evenly support piping for its entire length upon outside periphery of lower one third of pipe.

E. Where rock is encountered, undercut trenches by 3 inches, and fill with well tamped clean sand or pea gravel as required to correct pipe elevation.

F. After piping in the excavation has been installed and tested, backfill excavation to a point 6 inches above the piping using utility sand or pipe sand that is free of rocks and debris. Proceed evenly on both sides of the pipe and continuously tamp. Except as hereinafter noted, backfill more than 6 inches above the top of the pipe shall be made by using earth from the excavation placed in layers of 6 inch maximum depth. Compaction of each successive layer shall be achieved using a mechanical compactor.

G. Special care shall be taken when backfilling over and around wrapped or pre-insulated piping to prevent damage to the protective wrap and/or insulation.

H. Any backfill which subsides or settles below the adjacent finished grade or paving level during the guarantee period shall be brought to grade by the Contractor by adding compacted backfill or additional paving in paved areas.

I. See drawings and trench detail(s) for additional information and requirements.

3.2 ACCESS TO PLUMBING WORK

A. Comply with manufacturer's instructions for installation of access doors.

B. Access panels shall be furnished and installed wherever valves, balance valves, damper operating mechanisms, air terminal boxes, fans, and similar items normally requiring adjustment or servicing are installed in concealed or inaccessible spaces. Coordinate with the access doors shown on the architectural drawings.

C. Where access panels are detailed on architectural or plumbing drawings, sizes indicated thereon shall be used.

D. Where access panels are to be located in acoustic tile ceilings, the size of the access panel required shall be increased to properly fit the tile pattern without cutting into the tile.

3.3 FORMING, CUTTING, AND PATCHING

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of the plumbing work.

B. If this Contractor fails to coordinate with other contractors at the proper time or fails to locate items properly, resulting in extra work, the Contractor is responsible for the additional work, at no cost to the Owner.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for all work.

D. Cutting, patching, and repairing of existing (prior) construction to permit installation of piping, conduit, etc. is the responsibility of the Contractor. Repair or replace any damage that occurs to existing work in a first class manner using skilled mechanics for each trade involved.

E. Cut existing construction in a neat and workmanlike manner by the use of a concrete saw. Use of pneumatic devices is not acceptable.

F. Core openings through existing construction as required for the passage of any new piping and/or conduit. Cut holes of the minimum diameter required to suit the size of the pipe to be installed, including the associated insulation.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Sections 220530 (Hangers and Supports for Plumbing Systems) and 220540 (Seismic Bracing for Plumbing Systems).

B. Where special hanging or support of piping or equipment is detailed or shown on the drawings, the drawings shall be followed.

3.5 INSTALLATION OF VALVES

A. See Specification Section 220510 (Valves for Plumbing Systems).

3.6 INSTALLATION OF GAUGES

A. Provide gauge connections at the following locations:

Suction and discharge of domestic hot water recirculating pumps.
Elsewhere as shown on the drawings.

B. Gauges shall be provided in convenient locations within approximately 3 feet of the flanges or connections, and elsewhere as shown on the drawings.

3.7 INSTALLATION OF THERMOMETERS

A. Thermometers for piping systems shall be installed so that the liquid flows completely around the sensing well. Pipe sizes at the bulb shall be increased where necessary to allow for full flow without excessive resistance.

B. Thermometers shall be placed at all locations shown on the drawings.

C. In cases where the specified thermometers cannot be located so as to be easily read, a remote reading type thermometer shall be installed, as approved by the Architect/Engineer.

3.8 INSTALLATION OF CATHODIC PROTECTION

A. Install dielectric unions in the following locations:

1. In all metallic water and gas service connections to the building within 5 feet of the building wall. Install adjacent to the shutoff valve and above ground wherever possible.
2. At points of connections where copper water lines connect to steel domestic water heater tanks and other equipment.
3. At points in piping where dissimilar metal pipes are connected together.
4. Any special applications shown on the drawings.

B. Where steel or cast iron pipe in the ground connects to copper or brass piping above the ground, the transition from steel or cast iron pipe to the copper or brass pipe shall be made above ground in all cases and in an accessible location where practicable.

C. Where copper or brass piping is connected to steel or cast iron piping and the connection is buried in the ground, the connection shall be covered with coal tar protective tape as specified in section ‘Pipes And Pipe Fittings’ extending outward a minimum of 5 feet on all pipes from the point of connection. The tape shall have a minimum thickness of 10 mils and a maximum thickness of 12 mils and shall be applied so as to provide at least two full thicknesses of tape over the piping. A primer specifically designed for use with the tape, shall be used. The piping shall be thoroughly cleaned before any tape or primer is applied.

C. Gauge Valves and Siphons
   1. A needle point globe valve, Crane No. 88 or equal, shall be installed at each gauge.
   2. A gauge siphon shall be installed at each hot water gauge.

3.9 INSTALLATION OF PIPE IDENTIFICATION

A. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.

B. The legend and flow arrow shall be applied at all valve locations, at all points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction, and at approximately 20 foot intervals on pipe runs.

C. Practical variations or changes in locations and spacing may be made with the specific approval of the Architect/Engineer to meet specific conditions.

D. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.

E. Markings shall be located to be conspicuous from any reasonable vantage point.

F. The legends and flow arrows shall be in the colors as indicated in the pipe marking schedule.

G. Pipe labels shall be as described in Section 2.20 of this specification (Piping and Equipment Identification).

H. Pipe Marking Schedule (Based on ANSI/ASME Standard A13.1-2023)

Service	Color
Domestic Cold Water	White Text on Green Background
Domestic Hot Water	Black Text on Gray Background
Non-Potable Cold Water	Black Text on Orange Background
Compressed Air	White Text on Bue Background
Fire Sprinkler Water	White Text on Red Background

I. Where different equipment such as fire sprinklers are supplied from a common main, such as a domestic water main, the main should be identified as ‘Domestic Water’ and each respective branch takeoff as ‘Fire Water’, etc.

J. Legacy Identification Schemes (Existing Facilities and Renovation Work): In existing facilities where the piping identification was previously labeled based on an earlier edition of ANSI/ASME Standard A13.1 (including the 1996 edition or the 2020 edition), the existing color scheme may be continued for renovation, alteration, and tenant improvement work, in accordance with the most current edition of ANSI/ASME Standard A13.1, provided that both of the following conditions are met:
   1. The existing scheme is described in writing and made available to building operation and maintenance personnel, or affected employees are trained on the operation and hazards of the piping systems; and
   2. The existing scheme is applied consistently throughout the affected systems within the facility. Where new piping systems are introduced into an existing facility under this work, the new piping shall be labeled in accordance with the existing facility scheme to maintain consistency, and the Contractor shall coordinate with the Owner to confirm the applicable scheme prior to ordering labels.

3.10 INSTALLATION OF FLASHINGS

A. Provide pipe flashings as noted on the drawings.

B. Flue and duct flashings and storm collars shall be securely clamped around flue and/or duct storm collars or counter-flashings.

3.11 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole and is flush with adjoining surface.

B. Sleeves: Secure sleeves to metal or wood forms in such a manner that they will not become displaced during pouring of concrete. Fill sleeves on deck with sand. After forms have been removed from concrete, the sleeves shall be removed from the openings.

C. Core drill properly sized holes in the concrete to replace metal sleeves that are crushed or knocked out of position during pouring of concrete.

D. Provide piping passing through concrete fire walls with sleeves of standard black steel pipe nominally one size larger than pipe enclosed, but in the case of insulated pipe, large enough for insulation to pass through. Caulk space between pipe and sleeve with fire-rated wicking, and provide metal retainer plates at both sides of the wall.

3.12 INSTALLATION OF WYE STRAINERS

A. Install wye strainers full size of the pipeline and in accordance with the manufacturer's installation instructions. Install pipe nipple and shutoff valve in the strainer blowdown connection, full size of the connection, except for strainers 2 inch and smaller installed ahead of control valves feeding individual equipment. Where indicated, provide a drain line from the shutoff valve to the nearest plumbing drain, same size as the blowdown connection.

B. Locate strainers in the supply line ahead of all pumps, temperature control valves, pressure reducing valves, temperature and pressure regulating valves, and elsewhere as indicated on the drawings if an integral strainer is not included with the equipment.

3.13 DEMOLITION WORK

A. Demolition work shall be performed only where specifically identified on the drawings. Unless specifically indicated otherwise, demolition work shall include removal of all associated equipment, electrical and controls components, conduit and wiring, piping, valves and accessories, and supports. The surfaces where the demolition work was performed shall be restored to match the adjacent surfaces to the best extent practical.

B. When demolition work involves leaving existing systems in place for a prolonged time period (more than 30 days and/or any time period when there is the potential for freezing temperatures) the Contractor shall protect all existing equipment, piping, and ductwork from potential damage during the time that the equipment, piping, and ductwork is out of service.

C. The protection procedures shall include draining all hydronic coils and the associated piping systems that may be susceptible to freezing temperatures when the building heating system is disabled. This requirement applies to both hydronic piping and domestic water piping systems.

D. After the piping systems are drained, the Contractor shall purge all water from the hydronic coils, hydronic piping systems, and domestic water piping systems using compressed air or other appropriate means, and shall seal any open ends such that the potential for corrosion is minimized. This work shall be performed by an experienced mechanical or plumbing contractor, rather than by a demolition contractor.

3.14 ELECTRICAL WORK

A. Adequate working space shall be provided around electrical equipment in compliance with the National Electrical Code and other applicable codes. Plumbing work shall be coordinated with the electrical work in order to comply with these requirements. Any work which does not conform to these requirements shall be corrected without additional cost to the Owner.

B. Furnish and install all line and low voltage control wiring in the plumbing work, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Unless noted otherwise, this does not include primary control wiring between starters and pushbuttons, or other manual starter switches.

C. Electrical Coordination

1. Starters located in motor control centers will be provided under the electrical work. The Contractor is referred to the electrical drawings for motors served by motor control centers.
2. Motors furnished under the plumbing work shall be furnished by the plumbing contractor, but connection to power wiring shall be by the electrical contractor. Coordinate all motor starter requirements with the electrical contractor.

D. Equipment furnished in this work that is factory-wired but requires modification to internal wiring to meet specifications or drawing requirements shall have such internal modifications made at the factory before shipment.

E. All electrical work and equipment, including internal wiring, shall comply with applicable codes and applicable portions of the electrical specifications. Route line and low voltage control wiring in conduit.

3.15 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. At completion, carefully clean and adjust all equipment and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.16 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.17 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 05 10 - VALVES FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of valves specified in this section include the following:

- Ball Valves
- Butterfly Valves
- Check Valves
- Gas Valves
- Manual Balance Valves
- Automatic Pressure-Compensating Balance Valves
- Motor Operated Valves
- Automatic Air Vent Valves
- Manual Air Vent Valves
- Pressure Relief Valves
- Temperature and Pressure Relief Valves
- Pressure Reducing Valves
- Emergency Gas Shutoff Valves
- Valve Tags

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of valves and piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Valve Types: Provide valves of the same type by the same manufacturer.

C. Identification: Provide valves and piping specialties with the manufacturer's name or trademark and pressure rating clearly marked on the valve body.

1.4 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each type of valve and piping specialty. Include a pressure drop curve or chart for each type and size of isolation valve, balancing valve, and control valve.

B. Operation and Maintenance Data: Submit operation and maintenance data and spare parts lists for each type of manufactured valve and piping specialty. Include this data and product data in the operating and maintenance manual in accordance with all associated requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide factory-fabricated valves and piping specialties as recommended by the manufacturer for use in the service indicated.

B. All valves, fittings, and accessories located in potable water systems shall be constructed of appropriate materials and conform to the requirements of NSF/ANSI Standards 61 and 372.

C. Unless otherwise indicated, provide valves of same size as the upstream pipe size.

D. Provide valves of type and with pressure ratings indicated for each service, or if not indicated, provide a proper selection to comply with the installation requirements. Provide sizes and connections which properly mate with piping, tubing, and equipment connections.

2.2 VALVES

A. Provide factory-fabricated valves of type and with pressure rating as indicated for each service, or if not indicated, provide proper valve selections complying with the installation requirements. Provide sizes and connections which properly mate with the pipe, tube, and equipment connections.

B. Unless otherwise indicated, valves shall be the same size as the upstream pipe size.

C. Provide valves as shown on drawings and as necessary to segregate piping branches and equipment. Furnish the flow performance curve for each valve.

D. Furnish discs suitable for the service intended. Properly pack and lubricate all valves per the valve manufacturer's recommendations.

E. Provide flanged valves in welded pipe, and provide ball valves in water lines, unless otherwise indicated on the drawings.

F. Valves at connections to appliances shall be Milwaukee BA-300, Nibco 595, or approved equal.

G. Valves shall be full size of pipe, NSF certified, manufactured by Nibco, Milwaukee, Apollo, or approved equal, in accordance with the following schedule and with the remainder of this specification section.

Ball Valves	3" and below	Nibco T-585HP-66-LF	Milwaukee UPBA-400S
Butterfly Valves	4" and above	Nibco LD-2022	Milwaukee HL-234E
Check Valves	2" and below	Nibco T-413-Y-LF	Milwaukee 508
	2-1/2" and above	Nibco F-910-B-LF	Milwaukee F-2970-M
Gas Valves	4" and below	Nibco T-FP-600A	Apollo 94ALF-A
	5" and above	Nordstrom 149	Resun R-1431-WGA

H. Ball Valves: All ball valves shall be two-piece bronze body with stainless steel ball and stem, PTFE packing/seats, and balancing handle. See the preceding table for acceptable manufacturers and models.

I. Butterfly Valves: All butterfly valves shall be lug style with ductile iron body, stainless steel disc and stem, EPDM liner and seals, and balancing handle with memory stop. See the preceding table for acceptable valve manufacturers and models.

J. Motorized Ball Valves: Provide motorized ball valves where indicated on the drawings. Motorized ball valves shall be Belimo B2 or B3 Series, or approved equal with nickel plated brass body and stainless steel ball and stem.

K. Motorized Butterfly Valves: Provide motorized butterfly valves where indicated on the drawings. Motorized butterfly valves shall be Belimo F6 Series, or approved equal with nickel plated brass body and stainless steel ball and stem.

L. Lockshield valves shall be lead-free ball type with locking lever, Nibco T-585-80-LF-LL, Crane D171LS, or approved equal.

M. Gate valves and their trim shall be selected for the specific service that they are associated with. Gate valves shall be Nibco T-113, Milwaukee UP-105, or approved equal.

N. Manual Balance Valves (2" and Below): Fixed port venturi style, IMI Flow Design AccuSetter UA Series, Pro Hydronic CBV Series, Taco Accu-Flo, Bell & Gossett Circuit Setter Plus, Nibco T-1810-LF, or approved equal. Variable orifice balancing valves are not acceptable.

O. Manual Balance Valves (2-1/2" and Above): Fixed port venturi style, IMI Flow Design AccuSetter AF Series, Hays Series CBVF, Nexus Series NVFB, Bell and Gossett Circuit Setter Plus, Nibco F739, or approved equal. Variable orifice balancing valves are not acceptable.

P. Automatic Pressure-Compensating Flow Control Valves: Valves shall include removable stainless steel cartridge, union, and test ports. Valves shall be Pro Hydronic Specialties Model AFLB (No Lead), IMI Flow Design Model ICSS (No Lead), Hays Mesurflo Model 2517 (No Lead), or approved equal. All ball valves shall have stainless steel ball and stem. All butterfly valves shall have stainless steel disc and stem.

Q. Automatic Air Vent Valves: Automatic air vents shall be furnished as indicated on the drawings and shall be Hoffman No. 79, Spirotherm Spirotop, or approved equal. Pipe vents to the nearest floor sink. Valve pressure rating shall be as required for the associated system.

R. Manual Air Vent Valves: Manual air vents shall be furnished as indicated on the drawings, complete with ball type isolation valve, Hoffman Model 78, or approved equal. Valve pressure rating shall be as required for the system in which installed.

2.3 VALVE TAGS

A. Tag each valve and provide a complete listing of valve locations and functions. Valve and tag listing shall be laminated and turned over to the Owner for posting as desired. In addition, where valves are located above a ceiling or behind an access panel, provide an adhesive clear plastic label with black 3/8" lettering on ceiling grid or access panel identifying the valve.

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

A. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

B. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane.

C. Provide a union at each connection to equipment, and at each threaded valve.

D. Install an isolation valve at the inlet of each equipment item, at each plumbing fixture, and elsewhere as indicated on the drawings.

E. Install a drain valve at each equipment item, located to completely drain the equipment for service or repair. Install at the base of each riser, at the base of each rise or drop in piping systems as required to completely drain each potable water system, and elsewhere as indicated on the drawings.

F. Install check valves with a minimum of 5 pipe diameters downstream of each pump discharge or change in direction (to avoid excessive turbulence at the check valve).

G. After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace the packing to stop leaks, and replace the valve if leakage persists.

3.2 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. At completion, carefully clean and adjust all equipment and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.3 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.4 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 05 20 - OPERATION AND MAINTENANCE OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Furnish the Architect/Engineer with two complete sets of typewritten operating and maintenance instructions, descriptive literature, catalog cuts, and diagrams covering all items of operation and maintenance for each and every plumbing system and piece of equipment furnished under these specifications.

B. In addition to the bound hard copies the Contractor shall provide an electronic copy (pdf file).

C. The Contractor shall commence compiling the above data (including obtaining operating and maintenance instruction data, catalog cuts, and diagrams from the manufacturer of the reviewed equipment) immediately upon review of his list of materials, so as not to delay the final installation and acceptance of the work.

D. Bind and index each set in a durable, hardboard binder. Final observation should not be requested until the operating and maintenance binders are submitted and have been reviewed by the Architect/Engineer.

E. Incorporate complete operating instructions including starting, stopping, and description of emergency manual operation methods for the following:

Plumbing Systems

Piping Systems

Temperature Controls

Test Data and Startup Reports

F. Provide charts and diagrams as required.

G. Provide operating manual for all equipment listed in individual sections of the specification.

H. Provide maintenance instructions for each item of individual equipment covering pertinent maintenance data, such as lubricants to be used, frequency of lubrication, inspections required, adjustments required, etc.

I. Provide parts bulletins containing manufacturer's part numbers, instructions, etc. for each item of equipment. Strip bulletins so that useless bulk is avoided.

J. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect/Engineer.

END OF SECTION

SECTION 22 05 30 - HANGERS AND SUPPORTS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing), 220500 (Basic Materials and Methods for Plumbing Systems), and Section 220540 (Seismic Bracing for Plumbing Systems) are hereby made a part of this section.

1.2 GENERAL

A. The following information is for pipe hanger and support layout and design reference only. The actual design of all hangers, supports, and seismic bracing is the responsibility of the Contractor per the following specification sections:

Specification Section 22 05 30 (Hangers and Supports for Plumbing Systems)
Specification Section 22 05 40 (Seismic Bracing for Plumbing Systems)

B. Piping: Hangers and supports for piping shall be designed in accordance with the latest adopted edition of the standards and codes listed below, and with any other applicable standards. Except in cases where a pipe stress analysis is performed to justify adjusted support and restraint spacing, pipe hangers and supports shall not be placed at intervals that are further apart than the requirements listed in UPC Table 313.3 and in UMC Table 313.3.

Steel Piping	Maximum Spacing	Reference
1-1/4” and smaller	7 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/2”	9 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2”	10 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2-1/2”	11 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3”	12 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3-1/2”	13 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
4”	14 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
5”	16 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
6”	17 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
8”	19 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
10”	22 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
12”	23 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
14”	25 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
Copper Piping	**Maximum Spacing**	**Reference**
3/4” and smaller	5 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1”	6 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/4”	7 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/2”	8 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2”	8 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2-1/2”	9 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3”	10 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3-1/2”	11 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
4”	12 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
5”	13 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
6”	14 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
8”	16 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
Gas Piping	**Maximum Spacing**	**Reference**
1/2”	6 feet	International Fuel Gas Code
3/4” & 1”	8 feet	International Fuel Gas Code
1-1/4” and larger	10 feet	International Fuel Gas Code

1.3 SUMMARY

A. This section Includes:
   1. Metal pipe hangers and supports
   2. Thermal hanger shield inserts
   3. Fastener systems
   4. Pipe stands
   5. Equipment stands
   6. Equipment supports

B. Related Requirements: All hangers and support systems shall be designed, selected, and installed by the Contractor to comply with the requirements listed in Section 220540 (Seismic Bracing for Plumbing Piping and Equipment).

C. Costs for hanger, support, and seismic bracing systems complying with the requirements listed herein are the responsibility of the Contractor and shall be included in the Contractor's bid. No extra cost will be allowed for failure to include the associated costs in the Contractor's bid.

D. In no case shall hangers and/or supports for plumbing piping or equipment be attached to a metal roof deck, unless provisions or allowances are explicitly shown on the structural drawings.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer**.** Show fabrication and installation details and include calculations for the following (Include product data for all components):
   1. Trapeze Pipe Hangers
   2. Metal Framing (Strut) Systems
   3. Pipe Stands
   4. Equipment Supports

C. Provide comprehensive, all-inclusive, delegated design submittals for all listed items. Submittals shall comply with all performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Details for fabrication and assembly of trapeze hangers.
   2. Design calculations utilized for designing the trapeze hangers.

D. The work of this section shall be coordinated with the requirements for the Contractor furnished seismic design submittal for hangers and supports specified in Section 220540 (Seismic Bracing for Plumbing Piping and Equipment). Design and detailing of seismic bracing, hangers, and supports is the responsibility of the Contractor.

E. Submittals shall be fully coordinated with the structural drawings and shall include all applicable structural and seismic attachment details. Locations and the methods of attachment of hangers and supports to the main structural frame shall comply with the limitations specified in the structural drawings. Submittals shall include all support anchorage loads and vectors broken out by discrete load type. Each specific load shall be indicated in the submittals and the structural element that the support is attached to shall be clearly depicted/identified.

F. Shop drawing submittals will be reviewed by both the design mechanical engineer and the design structural engineer (structural engineer when applicable)

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, 'Structural Welding Code - Steel'.

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE Standard 7-16.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic restraint hangers and supports for piping and equipment.
4. Design of connections for hangers, supports, and bracing shall comply with the requirements indicated on the structural drawings

2.2 GENERAL MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory mixed and packaged, dry hydraulic cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, non-corrosive, and non-gaseous.
2. Design Mix: 5,000 psi, 28 day compressive strength.

2.3 PLUMBING EQUIPMENT HANGERS AND SUPPORTS

A. Provide delegated design as applicable for the specific equipment.

2.4 PLUMBING PIPE HANGERS AND SUPPORTS

A. Carbon Steel Pipe Hangers and Supports

1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized, hot dip galvanized, or electro-galvanized.
3. Non-Metallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support the bearing surface of the piping.
5. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

B. Stainless Steel Pipe Hangers and Supports
   1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   3. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

C. Copper Pipe and Tube Hangers
   1. Description: MSS SP-58, Types 1 through 58, copper plated steel, factory fabricated components.
   2. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

2.5 HANGER AND SUPPORT MATERIALS

A. Additional hanger and support requirements are listed in sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger shield inserts for insulated piping and tubing.

I. Horizontal Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes 1/2” thru 30” size.
   2. Yoke Type Pipe Clamps (MSS Type 2): For suspension of up to 1050°F, pipes 4” thru 24” size, requiring up to 4 inchesof insulation.
   3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes 3/4” thru 36” size, requiring clamp flexibility and up to 4 inchesof insulation.
   4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes 1/2” thru 24” size if little or no insulation is required.
   5. Pipe Hangers (MSS Type 5): For suspension of pipes 1/2” thru 4” size, to allow off-center closure for hanger installation before pipe erection.
   6. Adjustable Swivel Split or Solid Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes 3/4” thru 8” size.
   7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
   8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
   9. Adjustable, Swivel Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
   10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes 3/8” thru 8” size.

11. Extension Hinged or Two Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes 3/8” thru 3” size.
12. U-Bolts (MSS Type 24): For support of heavy pipes 1/2” thru 30” size.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes 4” thru 36” size, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes 4” thru 36” size, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion type support for pipes 2-1/2” thru 3” size, 6” size if vertical adjustment is required, with steel pipe base stanchion support and cast iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes 1” thru 3” size, from two rods if longitudinal movement caused by expansion and contraction may occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes 2-1/2” thru 24” size, from single rod if horizontal movement caused by expansion and contraction may occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2” thru 42” size if longitudinal movement caused by expansion and contraction may occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes 2” thru 24” size if small horizontal movement caused by expansion and contraction may occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes 2” thru 30” size if vertical and lateral adjustment during installation may be required in addition to expansion and contraction.

J. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers 3/4” thru 24” size.
   2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers 3/4” thru 24” size if longer ends are required for riser clamps.

K. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inchesfor heavy loads.
   2. Steel Clevises (MSS Type 14): For 120°F to 450°Fpiping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120°F to 450°Fpiping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lbs.
    b. Medium (MSS Type 32): 1,500 lbs.
    c. Heavy (MSS Type 33): 3,000 lbs.
13. Side Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary, to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load adjustment capability. These supports include the following types:
   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe hanger selections and applications that are not specified in piping system sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system sections.

Q. Use powder actuated fasteners and mechanical expansion anchors instead of building attachments where required in concrete construction.

2.6 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop or field fabricated pipe support assembly made from structural carbon steel shapes with MSS SP-58 carbon steel hanger rods, nuts, saddles, and U-bolts.

2.7 METAL FRAMING (STRUT) SYSTEMS

A. Metal Framing Manufacturers Association (MFMA) Metal Framing Systems
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      B-line
      Unistrut
      Flex-Strut
      G-Strut
      Miro Industries

   2. Description: Shop or field fabricated, pipe support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Standard: Comply with MFMA-4 factory fabricated components for field assembly.
   4. Channels: Continuous slotted carbon steel channel with in-turned lips.
   5. Channel Width: Selected for applicable load criteria.
   6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   7. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.
   8. Metallic Coating: Zinc dichromate finish applied over an electro-galvanized zinc plating.

2.8 THERMAL HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

   Pipe Shields
   nVent/Caddy
   Buckaroos

B. Insulation Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100 psior ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psiminimum compressive strength and vapor barrier.

C. Insulation Insert Material for Hot Piping: Water repellent treated, ASTM C533, Type I calcium silicate with 100 psiASTM C552, Type II cellular glass with 100 psior ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psiminimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inchesbeyond sheet metal shield for piping operating below ambient air temperature.

G. Structural insert material for hot piping shall be water resistant, high density, calcium silicate with minimum a density of 28 lbs/ft^3 and a minimum compressive strength of 900 psi. Structural inserts shall be used as recommended by the manufacturer to meet load ratings.

H. Structural insert material for cold piping shall be water resistant, high density, polyisocyanurate with a minimum density of 14 lbs/ft^3 and a minimum compressive strength of 900 psi. Structural inserts shall be used as recommended by manufacturer to meet load ratings.

I. Provide a vapor barrier steel jacket around insulation. Insulation jackets shall be galvanized steel conforming to ASTM A653. Hanger bearing surface shall consist of a galvanized sheet metal insulation protection shield or casing.

J. Thermal hanger supports shall be load rated. Load ratings shall be established by the pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes and standards: ASME B31.1, MSS SP-68, MSS SP-69, and MSS SP-89.

K. Unless otherwise indicated, thermal hanger supports shall be as indicated in the following schedule, or approved equal. The listed model numbers are based on Pipe Shields.
   1. Pipe supported on hangers: Models A2000, A4000, A9000, and D3000 series.
   2. Pipe supported on flat surfaces: Models A2000, A4000, A6000, A7000, A7200, and A7400.
   3. Pipe Supported on pipe rolls: Models A4000, A6000, A8200, and A8400.
   4. Pipe supported on slides and guides: Model B series.
   5. Riser pipe supports: Model E series.

L. The selected model(s) shall conform to pipe service, support style, and support spacing.

M. Pipe support spacing shall be in accordance with the manufacturer’s recommendations, but in no case shall exceed the maximum spacing required by ASME B31.1.

2.9 FASTENER SYSTEMS

A. Powder Actuated Fasteners: Threaded steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Powder actuated fasteners may only be utilized for point loads of 50 lbs or less.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Hilti
      ITW Ramset/Red Head
      Simpson Strong-Tie

B. Mechanical Expansion Anchors: Insert wedge type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated stainless steel.
   2. Outdoor Applications: Stainless steel.
   3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Hilti
      ITW Ramset/Red Head
      B-line

2.10 PIPE STANDS

A. General Requirements for Pipe Stands: Shop or field fabricated assemblies made of manufactured corrosion resistant components to support roof mounted piping.

B. Compact Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Single base unit with integral rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
   3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   4. Hardware: Galvanized steel or polycarbonate.
   5. Accessories: Protection pads.

C. Low Profile, Single Base, Single Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
   3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   4. Vertical Members: Two galvanized steel, continuous thread 1/2 inchrods.
   5. Horizontal Member: Adjustable horizontal, galvanized steel pipe support channels.
   6. Pipe Supports: Roller strut clamps, clevis hanger, or swivel hanger.
   7. Hardware: Galvanized steel.
   8. Accessories: Protection pads.
   9. Height: 12 inchesabove the roof, or as indicated on the drawings.

D. High Profile, Multiple Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   3. Bases: Two or more vulcanized rubber molded polypropylene insert material.
   4. Vertical Members: Two or more galvanized steel channels.
   5. Horizontal Members: One or more, adjustable height, galvanized steel pipe supports.
   6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
   7. Hardware: Galvanized steel.
   8. Accessories: Protection pads**,** 1/2 inchcontinuous thread rod.
   9. Height: 24 inchesabove the roof or as indicated on the drawings.

E. Curb Mounted Type Pipe Stands: Shop or field fabricated pipe supports made from structural steel shapes, continuous thread rods, and rollers, for mounting on permanent stationary roof curb.

2.11 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment support made from structural carbon steel shapes.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with all requirements in other section of the specifications for firestopping materials and installation for penetrations through fire rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A36/A36M, carbon steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation
   1. Install powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inchesthick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.
   2. Install mechanical expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation
   1. Pipe Stand Types Except Curb Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate the roof membrane.
   2. Curb Mounted Type Pipe Stands: Assemble components or fabricate pipe stands and mounts on a permanent, stationary roof curb.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2” pipe size and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. 1/2” to 3-1/2” pipe: 12 incheslong and 0.048 inchthick.
      b. 4” and 5” pipe: 18 incheslong and 0.06 inchthick.
      c. 8” thru 14” pipe: 24 incheslong and 0.075 inchthick.
   5. Pipes 8”and Larger: Include wood or reinforced calcium silicate insulation inserts of length at least as long as protective shield.
   6. Thermal Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT HANGERS/SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor. Provide lateral bracing to prevent swaying for equipment supports.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing for equipment supports to prevent swaying.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780/A780M.

END OF SECTION

SECTION 22 07 00 - INSULATION FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing insulation specified in this section include the following:

Domestic Cold Water Piping (Indoors)
Domestic Hot Water Supply and Return Piping
ADA Compliant Plumbing Fixtures
Removable Insulation Jackets
Equipment Insulation

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: A firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Install thermal insulation products on equipment in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

D. Flame/Smoke Ratings: For insulation installed inside the building provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with a flame spread rating of 25 or less and a smoke developed index of 50 or less, complying with ASTM E84.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-Value, thickness, density, and furnished accessories for each plumbing system requiring insulation. Include complete description of installation methods with this submittal.

PART 2 - PRODUCTS

2.1 PIPE INSULATION MATERIALS

A. All pipe insulation thicknesses and conductivities shall meet or exceed the requirements listed in International Energy Conservation Code Section C404.4 and in the Uniform Plumbing Code (whichever is more stringent). All conductivity values listed in this specification section are in Btu-in/(hr-ft^2-°F).

B. Aluminum Jacketing shall be provided on exposed piping and shall be Johns Manville ‘JM Aluminum Jacketing’ with ‘Polyfilm Moisture Barrier’ and stucco-embossed finish, or approved equal, and shall be provided where indicated, in the following thicknesses:

1. For Insulation Outside Diameters under 8 inches: .016 inch thick jacketing
2. For Insulation Outside Diameters 8 inch and larger: .020 inch thick jacketing

C. Exposed in all piping applications shall mean any exposed pipe in a mechanical room or mezzanine area that is less than 8’-0” above finished floor.

D. Fiberglass Insulation

1. Fiberglass insulation shall be Johns Manville Microlok HP, or equal, with factory-applied fire-retardant ASJ jacket, self-sealing laps, and shall be applied per the manufacturer's written recommendations. Conductivity shall be .24 Btu-in/(hr-ft^2-°F) at 100°F.
2. Insulate and cover all fittings with Johns Manville Zeston Series 2000 pre-molded fitting covers secured with serrated tacks, adhesive, and/or Zeston Z-Tape.
3. Install a segment of rigid calcium silicate insulation at each pipe hanger for pipe sizes 2-1/2 inches and larger.
4. Finish all cold fittings with Zeston Z-tape to provide a vapor-tight seal.
5. Seal all raw ends and exposed fiberglass insulation with Childers CP-10 weather barrier sealant, or approved equal.
6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Johns Manville
   Knauf
   Owens Corning

2.2 DOMESTIC COLD WATER PIPING (INDOORS)

A. Insulate exposed domestic cold water piping with fiberglass insulation covered with aluminum jacketing and aluminum fitting covers.

B. Insulate concealed domestic cold water piping with fiberglass insulation. Do not insulate unions, valves, and exposed runouts to fixtures served with domestic cold water piping.

1. Minimum Insulation Thickness (All pipe sizes): 1 inch

2.3 DOMESTIC HOT WATER PIPING (INDOORS)

A. Insulate exposed domestic hot water supply and return piping with fiberglass insulation covered with aluminum jacketing and aluminum fitting covers.

B. Insulate concealed domestic hot water supply and return piping with fiberglass insulation. Do not insulate unions, valves, and exposed runouts to fixtures in domestic hot water piping.

1. Minimum Insulation Thickness:
   a. Piping 1 inch and smaller: 1 inch
   b. Piping 1-1/4 and 1-1/2 inch: 1-1/2 inch
   c. Piping 2 inch and larger: 2 inch

2.4 ADA COMPLIANT PLUMBING FIXTURES

A. Insulate domestic hot water, domestic cold water, and waste piping below ADA compliant plumbing fixtures with Plumberex Pro-Extreme pipe covers, or approved equal. Covers shall be manufactured of 1/8 inch thick PVC with anti-microbial, anti-fungal, and UV-resistant properties. Covers shall have vandal resistant snap fasteners and shall comply with ASME A112.18.9.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING INSULATION

A. The term ‘piping’ used herein shall include pipe, valves, strainers, and fittings. Apply insulating cements to fittings, valves, and strainers, and trowel smooth to the thickness of adjacent covering. Covering on valves shall extend up to the bonnet. The covering cement shall be of the types herein specified

B. Install insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

C. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.

D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full length units of insulation, with single-cut pieces to complete each run. Do not use cut pieces or scraps abutting each other.

E. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

F. Extend piping insulation without interruption through walls, floors, and similar penetrations, except where otherwise indicated.

G. Install pipe hangers on the outside of the insulation and not in contact with the pipe.

3.2 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective insulation. Leave entire work in condition satisfactory to Architect. At completion, carefully clean equipment installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.3 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 08 00 - TESTING, ADJUSTING, AND BALANCING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Temperature performance testing on all heat transfer equipment and/or components.

B. Test and balance of plumbing distribution systems and associated equipment and apparatus.

C. Testing, setting, and adjusting speed and volume of systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by the contract documents.

D. Component types of testing, adjusting, and balancing specified in this section includes the following as applied to plumbing equipment:

Plumbing Pumps
Balancing Valves for Plumbing Systems

1.3 QUALITY ASSURANCE

A. Balance Agency: Provide services and facilities of an independent agency that specializes in testing, analysis, and balancing of hydronic systems and air distribution for heating and cooling systems. Work shall be done by qualified engineering technicians and trained personnel, using instruments certified accurate to limits used in standard practice for testing and balancing of hydronic and air distribution for heating and cooling systems. The agency shall field test air and hydronic flows in accordance with methods prescribed by the Associated Air Balance Council, National Standard Volume 1, latest edition.

B. The balance agency shall be a member of the Associated Air Balance Council. Subject to compliance with requirements, the balance agency shall be one of the following:
RS Analysis
Raglen System Balance

C. The balance agency shall submit the results of tests in this section to the Architect/Engineer for review and acceptance.

D. AABC Compliance: Comply with AABC ‘National Standards’ Volume 1, as applicable to plumbing systems and associated equipment and apparatus.

E. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting and balancing, except as otherwise indicated.

F. Reference Standards:

1. AABC (Associated Air Balance Council) AABC National Standards Volume 1
2. ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers)

G. Test Instruments: Utilize test instruments and equipment for the test and balance work required, of type, precision, and capacity as recommended in AABC National Standards Volume 1.

1.4 SUBMITTALS

A. Provide a test and balance agenda that includes step-by-step testing and balancing procedures, test sheets, and schematic drawings, all being specific to the project.

B. Provide submittals to indicate the extent of work proposed. Submit certified test reports as hereinafter specified signed by test and balance technician/supervisor that performed test and balance work.

C. Include identification and types of instruments used and their most recent calibration date with submission of final test report.

D. The completed balance report shall be submitted for review and approval prior to requesting final observation of the project.

1.5 GENERAL REQUIREMENTS

A. The balance agency shall perform the following during the installation phase of systems:

1. Study design drawings and specifications and prepare a schedule to physically inspect plumbing equipment and devices to be tested and balanced. The Contractor shall provide the balance agency with one copy of the contract drawings and specifications, plumbing equipment submittals, and change orders necessary for proper balancing of plumbing systems.
2. The balance agency shall make field inspections prior to closing in portions of systems to be balanced. Agency shall verify to its satisfaction that all work, fittings, dampers, balancing devices, etc. are properly fabricated and installed as shown or specified and that Agency will be able to properly balance system.
3. Prepare a testing and balancing schedule, test record forms, and necessary technical information regarding the plumbing systems and equipment.
4. Provide written documentation when the above noted items have been completed. A single page letter signed off by the plumbing contractor and the test and balance agency will suffice.
5. Recommend adjustments and/or corrections to plumbing equipment and piping systems that are necessary for proper balancing of systems. Provide written documentation of the recommended items to the Architect/Engineer for review.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 BALANCING

A. All water systems and balance valves shall be balanced to within -5% to +5% of design.

B. Upon completion of plumbing systems, the test and balance agency shall complete tests, analysis, and balance of plumbing systems and equipment as appropriate.

C. This report shall include as minimum, but not be limited to (following design and actual information):

1. Motors and Pumps: Horsepower, brake horsepower, revolutions per minute, actual amperage, and full load rated amperage.
2. Pumps: Suction and discharge pressures.
3. Other information required to establish completely balanced systems.

END OF SECTION

SECTION 22 09 00 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing fixtures addressed in this section include the following:

Water Closets
Lavatories
Mop Sinks
Sinks
Water Coolers/Bottle Fillers

1.3 QUALITY ASSURANCE

A. All plumbing fixtures shall be certified under the United States EPA WaterSense program, as required by Nevada Assembly Bill AB163.

B. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this section:

American National Standards Institute
Federal Standards
California Plumbing Code (for projects located in California)

C. All plumbing components within the waterways shall comply with the following:

Safe Drinking Water Act
No Lead Restrictions of ANSI/NSF Standard 61 Section 9

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

B. Include confirmation/verification that all fixtures are certified under the United States EPA WaterSense program.

C. Operation and Maintenance Data: Submit operation and maintenance data and replacement material lists for each type of material listed in this section. Include this data and product data in the operation and maintenance manual.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle plumbing fixtures carefully to prevent breakage, chipping, and scoring the fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PLUMBING FIXTURES

A. Consult architectural drawings, as well as plumbing drawings for locations, dimensions, and mounting heights of plumbing fixtures.
   1. Take location and mounting heights for rough-in from architectural drawings.
   2. Follow schedule on plumbing drawings for rough-in connections. Set rough-in for all fixtures exactly per measurements furnished by the manufacturers of the fixtures used.
   3. Rough-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

B. All fixtures shall be first class in every respect. Accurately line up finished plumbing. Take special care with the rough-in and finished plumbing where batteries of fixtures occur.

C. Provide all water supplies to fixtures with compression shutoff stops with IPS inlets, threaded brass nipples at pipe connection, and a lock-shield loose key. Provide combination fixtures with a compression stop on each water supply fitting. Provide loose key handle for each stop. Provide 1/2 inch rigid risers for all fixtures unless otherwise noted.

D. Furnish shutoff valves on hose bibbs directly connected to mains with no intervening valves.

E. Except where otherwise specified, all finish for exposed metal trim on fixture shall be polished chromium plated. This also applies to wall flanges, nuts, and washers. Handles on all faucets and stops shall be all metal chromium plated.

F. Make connection between fixtures and flanges on soil pipe absolutely gas tight and water tight with neoprene type gaskets (wall hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.

G. Provide fixtures not having integral traps with P-traps of chromium plated cast brass body without cleanout connected to concealed waste in wall and sanitary fittings. Provide fixtures with a 17 gauge minimum traps and tailpiece and grid drain unless otherwise noted.

H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering traps which may be incorporated in the work include the following, or approved equal:

   McGuire Manufacturing
   Dearborn Brass

I. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets.

2.2 PLUMBING FIXTURE HANGERS AND SUPPORTS

A. Properly install and support plumbing fixtures as required and specified herein.

B. Carriers and supports shall be J.R. Smith, Zurn, Mifab, or approved equal, as recommended by the manufacturer for the particular installation and type of fixture being installed. Residential type fixture supports are not acceptable.

C. Install wall mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.

D. Install floor mounted water closets with J.R. Smith, Mifab, or approved equal cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps.

E. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.
   Water Coolers/Bottle Fillers

F. Install wall hung lavatories in stud walls with concealed arms and floor support, with feet of support securely anchored to the floor. In addition, anchor top of support to wall construction.

G. Support multiple faucet wash basins by welding 6” steel plates (minimum 1/8” thick) directly behind the 16 gauge wall studs. Drill pilot holes into the plates, an fasten the sink bracket to the plate using 3/8” self-tapping screws, and then use 6” flat strap for the other attachment locations.

2.3 PLUMBING FIXTURES

A. Fixtures shall be American Standard, Sloan, Kohler, Haws, Elkay, Bradley, Just, Acorn, or approved equal.

B. Fixture manufacturer and model shall be as scheduled on the drawings, complete with all components and accessories as illustrated and described. Provide stops for all concealed supplies.

C. Flush valves used at handicapped water closets shall be mounted on the wide side of the toilet enclosure.

D. All water coolers, drinking fountains, and hydration stations shall include integral water filters that are accessible from the front of the enclosure.

2.4 WATER CLOSET SEATS

A. Provide seats for standard elongated bowls with self-sustaining check hinges, stainless steel posts, white color.

2.5 CAULKING

A. For plumbing fixtures that require caulking, the caulking shall be installed in a neat and professional manner, in accordance with the manufacturer’s written instructions.

B. Caulking color (white or clear) shall be confirmed in writing with the Architect/Engineer prior to ordering or installing.

C. Caulking shall be Oatey Tub-N-Tile, or approved equal by GE or Dap.

D. Caulking for correctional facilities shall be Surebond SB-190 ‘pick-proof’, or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine rough-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors, substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install plumbing fixtures of types indicated where shown and at mounting height indicated on Architectural Drawings in accordance with fixture manufacturer's written instructions, rough-n drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the Uniform Plumbing Code pertaining to installation of plumbing fixtures.

B. In all cases where plumbing fixtures are mounted on or against building walls of concrete or other materials having relatively rough or non-planar surfaces, it shall be the responsibility of this Contractor to provide any necessary grout or backing materials required to facilitate fixture mounting and eliminate void spaces between fixtures and wall to ensure adequate bearing contact.

1. On completion of installation provide silicone sealer at all points of fixture contact with walls or floors.

C. Any fixture broken, cracked, or otherwise damaged during installation shall be replaced by the Contractor at no cost to the Owner.

3.3 TRAPPING AND VENTING OF FIXTURES

A. Trap and vent all plumbing fixtures in accordance with the Uniform Plumbing Code, whether or not shown on the drawings. Strictly adhere to any and all local codes. The only exceptions (which require specific written approval) will be those fixtures which are specially noted herein or on the drawings to be provided with special wastes.

B. No vent shall intersect another vent at a point less than 6 inches above the extreme overflow level of highest fixture served.

C. Take vents off the top half of horizontal runs and grade so as to free vents quickly of any water or condensation.

3.4 ADJUSTMENT OF PLUMBING PIPING SYSTEM

A. Test and adjust all flush valves so that each fixture receives the proper amount of water. Regulate all faucets, bibbs, drinking fountains, etc. to the approval of the Architect/Engineer so that the entire system is left in a first class condition.

B. Clean fixtures, equipment, and materials installed under this contract. Remove any/all cement, plaster, paint, rust, etc. Also remove any/all dirt, rubbish, paint spots, or grease on walls or fixtures for which this Contractor is responsible.

3.5 CLEANING AND PROTECTION

A. Clean plumbing fixtures of all dirt and debris upon completion of installation.

B. Protect installed fixtures from dirt and damage during the remainder of the project.

3.6 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. When feasible, restore and match finish to the original at site. Otherwise, remove the fixture and replace with a new unit. Feasibility and match to be judged by the Architect/Engineer. Remove any cracked or dented units and replace with new units.

3.7 OWNER TOOLS

A. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to the Owner with receipt. Furnish one device for every 10 units.

3.8 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.9 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.10 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 10 00 - FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing piping materials and components specified in this section include the following:
   1. Materials and Products
   2. Basic Pipes and Fittings
   3. Basic Valves
   4. Automatic Air Vents
   5. Manual Air Vents
   6. Water Hammer Arrestors

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing piping systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required for this project.

C. Plumbing Code Compliance: Comply with applicable portions of the Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

B. As-Built Drawings: At project closeout, submit as-built drawings of installed piping systems.

C. Operation and Maintenance Data: Submit operation and maintenance data and parts lists for plumbing piping systems materials and products. Include this data, product data, shop drawings, and record drawings in the operation and maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with the Uniform Plumbing Code. Where more than one type of material or product is indicated, selection is the Contractor's option.

2.2 BASIC PIPES AND PIPE FITTINGS

A. Copper Tube and Fittings
   1. Copper Tube: ASTM B88, hard drawn temper, except as otherwise indicated.
   2. Wrought Copper Solder Joint Fittings: ANSI B16.22.

B. Provide pipe and pipe fittings complying with Section 220500 (Basic Materials and Methods for Plumbing) and in accordance with the following listing:
   1. Interior Water Piping (and Exterior Water Piping Exposed Above Grade)
      a. Pipe 2 inches and Smaller: Copper tube; Type L, hard drawn temper; with wrought copper fittings and solder joints.
      b. Pipe 2-1/2 inches and Larger: Copper tube; Type L, hard drawn temper; with wrought copper fittings and brazed joints.
   2. Exterior Water Piping Below Building Slab and/or other Concrete Slab
      a. Pipe 2 inches and Smaller: Copper tube; Type K soft copper; with no fittings.
      b. Pipe 2-1/2 inches through 3 inches:
         1) Copper tube; Type L, hard drawn temper; with wrought copper fittings and brazed joints.
         2) Polypropylene (PP-R) SDR 7.4 pipe, with socket-fusion, butt-fusion, fusion-outlet, or electro-fusion fittings and joints.
      c. Pipe 4 inches through 12 inches: Diamond Plastics 'Lok-21' AWWA C900 Polyvinyl Chloride (PVC) water pipe, Class 235, DR18, with restrained joints, or approved equal. Piping for potable water systems shall be certified under NSF Standard 61.
   3. Underground Piping Corrosion Protection
      a. All buried copper pipe and fittings shall be wrapped with polyethylene corrosion protection pipe wrap, labeled for the type of pipe and fittings that it covers. Pipe wrap shall be Christy's Polywrap, or approved equal.

2.3 VALVES

A. Provide valves complying with Section 220510 (Valves for Plumbing Systems).

2.4 AUTOMATIC AIR VENTS

A. Automatic air vents shall be furnished as indicated on the drawings and shall be rated for 150 psi at 250°F, and shall be Hoffman No. 78, Spirotherm Spirotop, or approved equal. Pipe vents to the nearest floor sink. Valve pressure rating shall be as required for the system in which installed.

2.5 MANUAL AIR VENTS

A. Manual air vents shall be furnished as indicated on the drawings and shall be rated for 150 psi at 250°F, and shall be Hoffman No. 78, Spirotherm Spirotop, or approved equal.

2.6 WATER HAMMER ARRESTORS

A. Install a manufactured water hammer arrestor in all water branch lines at single fixtures. Water hammer arrestors shall be sized per Plumbing Drainage Institute Standard PDI WH-201 'Water Hammer Arrestors'.

B. Where multiple fixtures are located in a row or battery install single or multiple water hammer arrestors, as appropriate. Water hammer arrestors for multiple fixture installations shall be sized and located per PDI Standard WH-201 and the manufacturer's installation instructions.

C. Water hammer arrestors shall have either threaded or soldered connections.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering water hammer arrestors which may be incorporated in the work include the following, or approved equal:

   Precision Plumbing Products SWA or SC Series

Sioux Chief 650 Series

PART 3 - EXECUTION

3.1 INSTALLATION OF WATER PIPING

A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.

B. Domestic hot water piping shall be re-circulated immediately behind each lavatory or group of lavatories (within 1 foot of each faucet, to ensure hot water availability within a reasonable time at low flow faucets).

C. Provide manufactured water hammer arrestors in water branch lines at single and multiple fixtures.
   1. Water hammer arrestors shall be located as close to the fixture as possible and in conjunction with the manufacturer's installation instructions.
   2. Where multiple fixtures are located in a row or battery a single or multiple water hammer arrestors, as required, may be used.
   3. Multiple fixture installations shall have the arrestor sized and located per PDI Standard WH-201 and the manufacturer's installation instructions.

D. Install piping on room side of building insulation.

E. Check final location of rubber rings within couplings on PVC water piping with gauge or as recommended by manufacturer. Make connections to valves with cast iron adapters connected to water pipe with cast iron couplings. Furnish and install anchors or thrust blocks.

F. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with any Work until all unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Specification Section 220500 (Basic Materials and Methods for Plumbing).

3.3 INSTALLATION OF VALVES

A. Install valves as indicated on the drawings and in the following locations:
   1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
   2. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere indicated or required to completely drain potable water system.

3.4 INSTALLATION OF AIR VENT VALVES

A. Automatic Air Vent Valves: Install automatic air vent valves at the top of each hydronic riser and elsewhere as indicated on the drawings. Install a shutoff valve between each riser and vent valve, pipe the outlet to a suitable plumbing drain or as indicated on the drawings.

B. Manual Air Vent Valves: Install manual air vent valves on each hydronic terminal at the highest point, and on each hydronic piping drop in the direction of flow for mains, branches, runouts, and elsewhere as indicated on the drawings.

3.5 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water runouts to fixtures of sizes indicated.

B. Mechanical Equipment Connections: Connect hot and cold water piping systems and gas piping systems to mechanical equipment as indicated, and provide a shutoff valve and union at each connection.

3.6 DOMESTIC WATER SYSTEM STERILIZATION

A. Close open ends of water piping each day to prevent contamination or foreign matter entering pipe during construction. Thoroughly flush out piping to remove any dirt or foreign matter.

B. After flushing of pipe systems, sterilize entire water systems from new point or points of connection before being turned over to Owner for use. Slowly fill system with water and add chlorine chemical agent to produce a minimum of 50 ppm of chlorine in the entering water.

C. Retain treated water in pipe for a minimum of 24 hours. Should chlorine residual at pipe extremities be less than 50 ppm at this time, piping shall be re-chlorinated. As an option, the water systems may be filled with a water and chlorine solution containing a minimum of 200 ppm of chlorine and allowed to stand for four hours.

D. After chlorination, flush lines of chlorinated water and refill from the domestic water supply. Continue flushing until residual chlorine is not greater than the chlorine residual in the flushing water at all pipe extremities. The procedure shall be repeated if it is shown by bacteriological examination made by an approved testing agency that contamination persists in the system.

E. Domestic water sterilization shall be performed in accordance with all requirements of the Nevada Division of Health, Water Supply Regulations (or equivalent authority on projects located in California). Approval of the State Health Division shall be obtained prior to placing the system in service.

F. Submit a written report to the State Health Division as required by State regulations. Provide a copy of the report to the Architect/Engineer prior to placing the system in service and prior to completion of project.

3.7 TESTING OF PIPING

A. Test piping in accordance with the following schedule. There shall be no loss in pressure and no visible leaks after a minimum duration of four hours at the test pressures indicated.

System Tested	Test Pressure	Test With
Hot and Cold Water Piping	150 psi at rough-in and 100 psi after equipment connection	Water

B. Testing equipment, materials, and labor shall be furnished by the Contractor.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to the extent required to overcome leakage. Chemicals, stop-leak compounds, mastics, or other temporary repair methods are not acceptable.

D. Drain test water from piping systems after all testing and repair work has been completed.

3.8 SPARE PARTS

A. Furnish to the Owner, with receipt, one valve key for each key operated hydrant, hose bibb, and faucet installed.

3.9 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion carefully clean and adjust all equipment, fixtures, and trim that is installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.10 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.11 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 10 15 - COPPER PIPING WITH PRESS FITTINGS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

B. Section 221000 (Facility Water Distribution Systems) is hereby made a part of this section.

1.2 REFERENCE STANDARDS

A. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings

B. ASTM B75 - Standard Specification for Seamless Copper Tube

C. ASTM B88 - Standard Specification for Seamless Copper Water Tube

D. ASTM F3226 - Standard Specification for Metallic Press-Connect Fittings for Piping & Tubing

E. IAPMO PS 117 - Press and Nail Connections

F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials

1.3 SEISMIC COMPLIANCE

A. All press fittings shall have seismic certification complying with IBC Section 1705.13.2/3. Certification shall be in accordance with the ICC Evaluation Service Seismic Certification (AC156), or approved equal.

1.4 QUALITY ASSURANCE

A. Installer Qualifications

1. Installers shall attend a manufacturer’s installation training class and be certified as having been trained and qualified to join piping with press-connect fittings. On-site training and credentialing by a manufacturer’s representative is acceptable.
2. Installers shall be qualified, trained, and certified in the installation of press-connect fittings.
3. Press-connect fittings shall be installed using proper tools, actuators, jaws, and rings as approved by the manufacturer.

1.5 WARRANTY

A. The warranty period for Viega ProPress fittings shall be 50 years from the date of installation, and shall cover any labor and material costs caused by failure of a properly installed fitting.

1.6 SUBMITTALS

A. Submittals shall include information indicating all press fittings, all press tools, and copies of the training certifications for all individuals that are planned to install press fittings on the project.

PART 2 - PRODUCTS

2.1 GENERAL

A. Copper piping with press fittings shall be utilized only when and where specifically identified on the drawings and shall be limited to a maximum pipe size of 2 inches.

2.2 VIEGA PROPRESS PIPE AND FITTINGS

A. Viega ProPress Copper and Cast Copper Alloy Press-Connect Fittings
   1. Viega Press-Connect Fittings are approved for use with copper tubing conforming to ASTM B88 or B75. See Specification Section 232100 (Hydronic Piping and Accessories) for acceptable pipe materials.
   2. Conform to ASME B16.51, ASTM F3226, IAPMO PS-117, NSF 61, and NSF 372. Copper alloy fittings shall be zero lead silicon bronze alloy C87710 (cast) or C88700 (machined). Bismuth bronze or yellow brass fittings are not acceptable.
   3. Sealing elements shall be uniform in size and thickness, and shall be free from manufactured deformities and/or indentations.
      a. Sealing elements for installations designed for water temperatures of 200°F and below shall have peroxide-cured EPDM elastomeric sealing elements rated for 300 psi and a temperature range rating of 0°F through 250°F.
   4. Press-Connect fittings shall have the 'Viega Smart Connect' feature integral to the fitting body to detect unpressed fittings during the testing process.
   5. Provide color coded markings on exterior of fitting for readily identifying/inspecting sealing element type.
   6. Approved Fitting Manufacturer: Viega (no exceptions).

B. Approved Tool Manufacturers for Installation of Press-Connect Fittings
   1. Viega, Milwaukee, and/or Rigid.

2.3 VIEGA PROPRESS VALVES

A. Viega ProPress ball valves, butterfly valves, and check valves are acceptable when shown on the drawings. All valves shall be appropriate for the system in which they are installed.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Join copper tube and press-connect fittings with tools recommended by the fitting manufacturer. The manufacturer's installation instructions shall be strictly adhered to.
   1. All connections shall bear full insertion marks on the tubing.
   2. Special attention shall be given to the required two step pressure test.
   3. Perform an initial 'Viega Smart Connect' test for unpressed fitting detection per the manufacturer's installation manual.
   4. The installer shall use an indelible marker to place their initials on the copper pipe immediately adjacent to each completed press fitting, prior to any insulation being installed.
   5. Training certificates for any individual installing press fittings shall be available on site for review by the Engineer and/or Owner.

3.2 TESTING OF PIPING

A. Test piping in accordance with the following schedule. There shall be no loss in pressure and no visible leaks after a minimum duration of four hours at the test pressures indicated.

TEST SCHEDULE

Systems Tested	
Cold Water Piping Hot Water Piping	
Test Pressure	Test Medium
150 psi at rough-in	Water

100 psi after equipment connection Water

B. Testing equipment, materials, and labor shall be furnished by the Contractor.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to the extent required to overcome leakage. Chemicals, stop-leak compounds, mastics, or other temporary repair methods are not acceptable.

D. Drain test water from piping systems after all testing and repair work has been completed.

3.3 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion carefully clean and adjust all equipment, fixtures, and trim that is installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.4 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.5 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing piping and accessories specified in this section include the following:
   1. Materials and Products
   2. Basic Pipes and Fittings
      a. Above Ground Building Drain Piping
      b. Below Ground Building Drain Piping
      c. Vent Piping
      d. Condensate Drain Piping
   3. Trap Seals
   4. Cleanouts
   5. Floor Drains and Floor Sinks
   6. Miscellaneous Drains

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing piping system products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems similar to that required for this project.

C. Plumbing Code Compliance: Comply with applicable portions of the Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping system materials and products.

B. As-Built Drawings: At project closeout, submit as-built drawings of installed piping systems in accordance with all associated requirements.

C. Operation and Maintenance Data: Submit operation and maintenance data and parts lists for all plumbing piping system materials and products. Include this data in the operation and maintenance manual in accordance with all associated requirements.

D. Sump Pump Product Data: Submit manufacturer’s pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated. Pump efficiency as well as construction will be taken into consideration when assessing the submitted pump.

E. Sump Pump Operation and Maintenance Data: Submit operation and maintenance data and parts lists for each type of pump, control, and accessory, including trouble-shooting maintenance guide. Include this data, product data, and shop drawings in the operation and maintenance manual, in accordance with all associated requirements.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with the Uniform Plumbing Code. Where more than one type of material or product is indicated, selection is the Contractor's option.

2.2 BASIC PIPES AND PIPE FITTINGS

A. Above Ground Building Drain Piping

1. Hubless cast iron soil pipe and fittings complying with the latest edition of CISPI Standard 301 and ASTM A888. Pipe and fittings shall be marked with the trademark of the Cast Iron Soil Pipe Institute.
2. Standard No-Hub Couplings: Provide banded couplings with neoprene gasket and Type 304 stainless steel clamp, screw, and shield, all in conformance with ASTM C564 and CISPI 310. Coupling shall be Anaco-Husky Standard No-Hub Coupling, or approved equal. Number of bands shall be as follows:

   Pipe Sizes 1-1/2” thru 4”: 2 Bands
   Pipe Sizes 5” thru 10”: 4 Bands
3. Heavy Duty No-Hub Couplings: Provide banded couplings with neoprene gasket and Type 304 stainless steel clamp, screw, and shield, all in conformance with ASTM C564. Coupling shall be Anaco-Husky Model HD-2000 Heavy Duty No-Hub Coupling, or approved equal. Number of bands shall be as follows:

   Pipe Sizes 1-1/2” thru 4”: 4 Bands
   Pipe Sizes 5” thru 10”: 6 Bands
4. Heavy duty no-hub couplings shall be installed on all exposed piping in mechanical rooms and storage rooms.
5. Heavy duty no-hub couplings shall be installed on all piping located over sensitive areas including kitchens, dining rooms, pharmacies, and laboratories.
6. Heavy duty no-hub couplings shall be installed on all piping located over critical care areas including, but not limited to, operating rooms, level 3 imaging rooms, etc.

B. Below Ground Building Drain Piping

1. Hubless cast iron soil pipe and fittings, complying with the latest edition of CISPI Standards 301 and ASTM A888. Pipe and fittings shall be marked with the trademark of the Cast Iron Soil Pipe Institute.
2. Hubless pipe couplings below grade shall be installed with 4 stainless steel clamps (6 for sizes 5” and above), 0.15” thick Type 304 stainless steel corrugated shield, 3/8” stainless steel bolts and nuts, and neoprene gasket in conformance with the ASTM C564 and ASTM C1540 for heavy duty shielded couplings. Couplings shall be Husky Model SD-4000, Ideal Tridon Heavy Duty, or approved equal.
3. See Specification Section 220500 (Basic Materials and Methods) for excavation and backfill requirements.

C. Vent Piping

1. Vent piping shall be hubless cast iron soil pipe and fittings, same as is specified for above-ground and/or below-ground building drain piping. Provide test tees where required by the Uniform Plumbing Code.

D. Cooling Coil Condensate Drain Piping

1. Type L, hard copper tubing with wrought copper solder joint fittings and 95 percent tin, 5 percent antimony solder. Condensate drain piping 1” and smaller shall use 45 degree wyes and long radius fittings at all changes in direction. Condensate drain piping 1-1/4” and larger shall use DWV fittings.

2.3 TRAP SEALS (TRAP GUARDS)

A. Provide trap seals only where specifically indicated on the drawings. Trap seals shall be IAPMO and ASSE 1072 approved.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering trap seals which may be incorporated in the work include the following, or approved equal:

Provent Systems ProSet Trap Guard
Jay R Smith Quad Close Trap Seal
Zurn Z-Shield Barrier Trap Seal

2.4 CLEANOUTS

A. General: Cleanouts of the same diameter as the pipe shall be installed in all horizontal soil and waste lines where indicated, and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding. Provide the listed products by Zurn, Mifab, or approved equal.

B. Cleanouts shall have cast iron ferrules and bronze plugs.

C. Cleanouts extending to floor level shall be provided with membrane flange and clamping collar, bronze raised head plug, and nonslip scoriated top.

1. Cleanouts in cast iron soil or waste lines: Zurn Z-1440-BP.
2. Cleanouts in walls: Zurn Z-1446-BP with stainless steel access cover.
3. Cleanouts at exterior of building: Zurn Z-1440-BP.
   a. Provide a stainless steel cover and vandal-proof screws where cleanouts are located in a wall. Zurn Z-1446-A.
   b. Where located at grade, provide an 18x18x6 inch concrete pad and a Zurn Z-1474 heavy duty cover with a Z-1440-A cleanout.
4. Cleanouts in concrete floors: Zurn ZN-1400
5. Cleanouts in terrazzo floors: Zurn Z-1400-T
6. Cleanouts in carpeted floors: Zurn ZN-1400-T-CM
7. Cleanouts in vinyl tile floors: Zurn ZN-1400-TX

2.5 FLOOR DRAINS AND FLOOR SINKS

A. Provide floor drains of size and type as scheduled and shown on the drawings, including all listed options and/or features. Floor drains shall be 5 inch size unless scheduled otherwise on the drawings. Provide a vented P-trap with a 1/2” trap primer connection below each floor drain and floor sink.

B. Install all floor drains and floor sinks in accordance with the manufacturer's written instructions and in the locations indicated on the drawings.

C. In the case of a shower and/or an above grade 2-pour concrete floor with a waterproofing membrane provide an anchor flange with seepage holes and clamp collar.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering floor drains and floor sinks which may be incorporated in the work include the following, or approved equal:

Zurn

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor.

3.2 INSTALLATION OF SANITARY DRAINAGE SYSTEMS

A. Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the drawings piping shall have invert elevations as shown and shall slope uniformly between the given elevations.

B. Run all drainage piping as straight as possible with long radius bends. Make all offsets at an angle of 45 degrees or less.

C. Locate piping runs, except as otherwise indicated on the drawings, vertically and horizontally (pitched to drain), and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations, or if not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.

D. Hold piping close to walls, overhead construction, columns, and other structural and/or permanent enclosure elements of the building. Limit clearance to 1/2 inch where furring is shown for enclosure or concealment of piping. Wherever possible in finished and occupied spaces, conceal piping from view by locating piping in column enclosures, in hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated on the drawings.

E. Conceal piping in finished portions of building above the floor line, except where otherwise shown or noted. Cutting of walls and floors shall be held to the minimum possible to attain a proper and functional installation.

F. Should structural difficulties or work of other trades prevent the running of pipes or the setting of equipment at the locations shown on the drawings, any necessary deviations determined by the Contractor, shall be submitted for review by the Architect/Engineer, and shall be installed without additional cost to the Owner.

G. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on the pipe and that there are no obstructions in the pipes and/or fittings.

H. Cap or plug openings in pipes and fittings immediately to prevent dirt entry until fixtures are installed and/or final connections are made.

I. Below grade hubless cast iron drainage piping shall be installed on smooth soil that does not contain rocks that could damage the piping and the area below fittings shall be hand-cleared to allow the pipe and fitting to be properly supported by the soil below.

J. Hubless Cast Iron Joints: Comply with the coupling manufacturer's assembly and installation instructions and with the latest edition of CISPI Standard 310-12.

K. PVC Joints: Comply with the coupling manufacturer's assembly and installation instructions and with the latest edition of ASTM D2321.

3.3 INSTALLATION OF CLEANOUTS

A. Cleanouts: Install in piping as indicated, at each change in direction of piping greater than 45 degrees, at maximum intervals of 50 feet for piping 4 inch and smaller, at maximum intervals of 100 feet for piping 5 inch and larger, and at the base of each conductor.

B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through waterproof membrane.

3.4 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

A. Set the top of each drain slightly below the floor to ensure drainage.

3.5 INSTALLATION OF SANITARY DRAINAGE VENT PIPING

A. Grade all vent piping such that it will free itself quickly of any water or condensation.

B. Where possible, join groups of vent risers together to allow one enlarged roof penetration.

3.6 TESTING OF PIPING

A. Test piping at completion of rough-in in accordance with the following schedule. There shall be no loss of water level or pressure and no visible leaks after the test duration listed below.

System Tested	Test Procedure	Test With
All Soil, Waste, Drain, & Vent Piping. Minimum height of standpipe shall be 10 feet above the piping being tested.	Fill with water to the top of the highest vent and allow to stand for a minimum of 4 hours without a loss of water.	Water

B. At the Contractor's option, piping may be tested with air per UPC Section 712.3.

C. Testing equipment, materials, and labor shall be furnished by this Contractor.

D. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

E. Drain test water from piping systems after testing and repair work has been completed.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Section 220500 (Basic Materials and Methods for Plumbing).

3.8 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion carefully clean and adjust all equipment, fixtures, and trim that is installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.9 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.10 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this section.

B. This section lists general requirements for Heating, Ventilating, and Air Conditioning (HVAC) work and is hereby made a part of each Division 23 specification section.

C. For convenience or reference the Specifications are separated into Divisions and Sections. Such separations shall not operate to make the Engineer an arbitrator to establish subcontract limits between the Prime Contractor and his Subcontractors. In any case, the Prime Contractor is responsible to the owner for a complete job.

D. Wherever the word ‘provide’ is utilized with regard to materials or equipment on the drawings or in the specifications it shall be interpreted to mean ‘furnish and install’.

E. The term ‘exposed’ shall be interpreted to mean any equipment, ductwork, or piping that is not concealed above a continuous ceiling or inside a finished wall.

1.2 WORK INCLUDED

A. This section consists of general requirements and standard specifications covering certain parts of the HVAC work and is supplemented by other Division 23 specification sections covering additional work, requirements, and materials specifically applicable to the HVAC work of each section. Requirements of subsequent sections of the specifications, if in conflict with these general requirements, shall govern.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Provide work and materials in full accordance with the latest rules and regulations of the following:

Nevada

2024 International Building Code
2024 International Existing Building Code (when applicable)
2024 Uniform Mechanical Code
2024 Uniform Plumbing Code
2024 International Energy Conservation Code
2023 National Electrical Code
2024 International Fire Code
2024 NFPA Codes and Standards
Nevada State Fire Marshal
Nevada Occupational Safety and Health
National Fire Protection Association
Underwriters Laboratories
All other applicable state codes, rules, and regulations

B. Nothing in the drawings or specifications shall be construed to permit work not conforming to the listed codes and regulations.

C. In the event of an inconsistency between or within the plans, specifications, any of the contract documents, codes, or regulations, the better quality, higher cost, and/or greater quantity of materials and work shall be provided at no additional cost to the Owner.

1.4 FEES, PERMITS, AND UTILITY SERVICES

A. Obtain and pay for all permits and service required for installation of this work; arrange for required inspections and secure approvals from the authorities having jurisdiction.

B. Arrange for utility connections and coordinate work with utility company.

C. Arrange required inspections and secure approvals from the authorities having jurisdiction.

1.5 SITE EXAMINATION

A. Examine site, verify dimensions and locations against drawings, and inform self of conditions under which work is to be done before submitting proposal. No allowance will be made for extra expense on account of error.

B. Information shown relative to existing services is based upon available records and data but is approximate only. Make minor deviations found necessary to conform to actual locations and conditions without extra cost. Verify location and elevation of all utilities prior to commencement of excavation for new piping or its installation.

C. Exercise extreme care in excavating near existing utilities to avoid any damage thereto. This Contractor is responsible for any damage caused by his operations.

1.6 PLACEMENT OF EQUIPMENT AND WORK

A. The placement of equipment and mechanical work in the locations and spaces shown on the drawings is the Contractor’s responsibility.

B. Move equipment and/or work into spaces through openings provided or located in the spaces during construction, as required.

C. Perform disassembling and reassembling of equipment and/or other work necessary to accomplish this requirement without extra cost to the Owner.

1.7 SUBMITTALS AND SUBSTITUTIONS

A. In all cases, there is one basis of design manufacturer or product for each item of equipment or product shown on the drawings and/or specified herein. These products are identified by name and model number on the drawings and/or in the specifications. Alternative manufacturers and products are also listed; however, their inclusion as an alternative manufacturer or product does not cause them to be the basis of design. If an alternative manufacturer and/or product is desired to be used by the Contractor, it will be considered a substitution. Substitutions will be interpreted to be all manufacturers or products other than the basis of design. Only one request for substitution will be considered for each item of material or equipment. No substitutions will be considered thereafter. After a substitution request is reviewed and is found to be unacceptable the Architect/Engineer reserves the right to require the originally specified equipment or product at no additional cost to the Owner.

B. If the Contractor desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified. No substitutions will be allowed unless requested and reviewed in writing. The Architect/Engineer will review and take appropriate action on shop drawings, product data, samples, and other submittals as required by the contract documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the contract documents.

C. The review of submittals will not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Architect/Engineer shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the Contractor, nor shall the Architect/Engineer be required to review partial submissions or those for which submissions for correlated items have not been received. The Architect/Engineer reserves the right to require the originally specified item.

D. Installation of reviewed substitutions is the Contractor's responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the Owner. Review by the Architect/Engineer of the substituted equipment and/or the dimensioned drawings does not waive the requirements stated herein.

E. In any case where the Contractor intends to utilize a listed or unlisted acceptable equipment manufacturer that is not the basis of design as listed on the drawings and in the specifications it is the Contractor's responsibility to confirm prior to bidding that all ductwork, piping, controls, electrical power, conduit, service clearances, space requirements, and structural requirements match those of the basis of design equipment. Costs for any revisions necessary to accommodate the ductwork, piping, controls, electrical power, conduit, service clearances, space requirements, and structural requirements for the alternative equipment are the responsibility of the Contractor and shall be included in the Contractor's bid. No extra cost will be allowed for failure to allow for accommodations related to the alternative equipment in the Contractor's bid.

F. Submit to the Architect/Engineer for review, within a reasonable time after award of Contract and in ample time to avoid delay of construction, shop drawings or submittals on all items of equipment and materials, including all substitutions. Also see Division 1 for additional related requirements.

G. Partial or incomplete sets of equipment and materials submittals will not be acceptable.

H. Assessment of quantities is solely the Contractor's responsibility and will not be reviewed.

I. All submittal data shall be tailored to suit the specific project, with appropriate model or part numbers, materials, sizes, options, and accessories clearly indicated for each different submittal item and on each submittal page. Submittal pages without this information will be returned and will need to be resubmitted with all of the required information indicated on each sheet.

J. The Contractor shall certify that he has examined all submittal data and that the equipment and materials submitted for review meet or exceed the requirements of the drawings and specifications. Submittals without the required certification will not be acceptable.

K. Should the Contractor neglect to include submittal data for any item of equipment or material it shall be assumed and agreed that the associated equipment or material is the exact item specified as the basis of design on the drawings and in the specifications.

L. Items indicated by the Architect/Engineer to be resubmitted shall be resubmitted as follows:
   1. Retain items marked as 'No Exceptions Taken' or 'Make Corrections Noted' and resubmit with the revised package. Do not provide new sheets for these items.
   2. Provide revised submittal sheets for all other reviewed items. Provide originally submitted sheet with Architect/Engineer comments. Clearly indicate amendments and modifications made in response to previous submittal review comments.

M. Electronic Formatted Submittals
   1. Provide submittals in electronic form (.pdf file format).
   2. Identify and incorporate submitted information, including a cover sheet, and the following:
      a. Project Name
      b. Submittal Package Number (with revision number identified)
      c. Date
      d. Name of Architect/Engineer
      e. Name of Contractor
      f. Name of Subcontractor
   3. Group submitted items by specification section, and provide the following:
      a. Index of submitted products with page numbers
      b. Name of Firm or entity that prepared submittal
      c. Name of Supplier
      d. Name of Manufacturer
      e. Equipment and/or fixture tag, if applicable
      f. Number and title of appropriate specification section
   4. Items indicated by the Architect/Engineer to be resubmitted shall be resubmitted as follows:
      a. Retain items marked as 'No Exceptions Taken' or 'Make Corrections Noted' and resubmit with the revised package. Do not provide new sheets for these items.
      b. Provide revised submittal sheets for all other reviewed items.
      c. Provide originally submitted sheet with Architect/Engineer comments.
      d. Clearly indicate amendments and modifications made in response to previous submittal review comments.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Mention herein or on the drawings requires that this Contractor provide each item listed of the quality noted, or equal. All material shall be new, full weight, standard in all respects, and in first class condition. Provide materials of the same brand or manufacturer throughout for each class of material or equipment wherever possible. Materials shall be tested within the continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements.

B. The grade or quality of materials desired is indicated by the trade names and/or catalog numbers stated on the drawings and in the specifications.

C. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without the written permission of the Architect/Engineer.

D. All equipment shall comply with the mandatory equipment efficiencies listed in International Energy Conservation Code Section C403.3.2.

E. No material installed as part of this work shall contain asbestos in any form.

2.2 MATERIALS FURNISHED

A. Identify all materials and equipment by the manufacturer's name and model number. Remove any unidentified materials and equipment from the site.

B. Equipment scheduled and/or specified by the manufacturer's model number shall include all accessories, controls, etc. listed in the catalog as standard with the equipment. Furnish optional or additional accessories as scheduled and/or specified.

C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged, and shall be replaced with new equipment. Variance from this requirement will be permitted only with the written consent of the Architect/Engineer.

D. Provide an authorized representative to constantly supervise the work of this division. Check all materials prior to installation for conformance with drawings and specifications.

PART 3 - EXECUTION

3.1 ACCESS TO HVAC WORK

A. Comply with manufacturer's written instructions for installation of access doors.

B. Access panels shall be furnished and installed wherever valves, balance valves, damper operating mechanisms, air terminal boxes, fans, and similar items normally requiring adjustment or servicing are installed in concealed or inaccessible spaces. Coordinate with access doors shown on architectural drawings.

C. Continuously check architectural drawings for clearance and accessibility of equipment specified herein to be placed. No allowance of any kind will be made for negligence on part of the Contractor to foresee means of installing his equipment into proper position.

3.2 DRAWINGS AND COORDINATION

A. General arrangement and location of piping, ductwork, equipment, etc. are shown on the drawings or herein specified. Carefully examine other work that may conflict with this work. Install this work in harmony with other crafts and at proper time to avoid delay of work.

B. In advance of construction, work out minor changes and relocations to suit actual conditions and work of other trades to avoid any conflicts. This shall not be cause for additional cost.

C. Verify all measurements at the building and be responsible for the correctness of same. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the drawings.

D. In addition, obtain all necessary information from the other trades regarding centers of partitions, walls, location of plumbing mains, fire sprinkler mains, and electrical conduits, ducts, pipes, etc. in order that pipes, equipment, and ductwork may be placed in their correct positions.

E. Execute all work shown on the drawings and not mentioned in the specifications, or vice versa, the same as if specifically mentioned by both. Omission from drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve the Contractor of furnishing and installing same in a complete and operational condition.

F. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and operational system.

G. Furnish materials and work at proper time to avoid delay of the work.

3.3 AS-BUILT DRAWINGS

A. Upon completion of work submit to the Architect/Engineer as-built drawings showing all changes in equipment, piping, ductwork, etc. installed as part of this project which are not in accordance with the contract drawings. As-built drawing deliverables shall be in accordance with the requirements of Division 1, and shall consist of the following as a minimum.

1. Provide as-built drawings in electronic file format (pdf file). In addition to the electronic file, when field mark-ups have been utilized, provide a complete set of full size neatly and legibly marked as-built drawings on 20 pound white bond paper.
2. As-built drawings shall be full size (same size as the contract documents) and shall be standard engineering scale. The minimum drawing scale shall match those provided in the contract documents.
3. As-built drawings shall include all outside utility connections, piping, etc. installed under this Contract. Locate and dimension all work with reference to permanent landmarks.

B. Match all symbols and designations used in the contract drawings when preparing the as-built drawings.

C. Indicate clearly and correctly all work installed differently from that shown, and maintain records up to date as work progresses. Include invert elevations of pipes below grade of floor, the floor lines, plugged wyes, tees, caps, exact locations and sizing of piping, location of valves, and the like. Dimension locations from structural points.

D. Properly identify all stubs for future connections as to locations and use by setting of concrete markers at finished grade in manner suitable to the Architect/Engineer.

3.4 PROJECT MODIFICATIONS

A. During the progress of construction, if any conditions arise that necessitate revisions, modifications, or relocation of any mechanical equipment or materials, such revisions shall be immediately brought to the attention of the Architect/Engineer. The Contractor shall then prepare necessary drawings showing the proposed changes. All proposed changes shall be submitted, reviewed, and approved by the Architect/Engineer prior to proceeding with any associated revision work in the field.

B. Maintain copies of all approved changes at the project site for reference by all parties during the remaining work.

C. Incorporate all revisions into the as-built drawings.

3.5 CLOSING IN OF UNINSPECTED WORK

A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected and tested. Should work be enclosed or covered up before it has been inspected and tested, uncover work at own expense. After it has been inspected and tested, make repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.6 FORMING, CUTTING, AND PATCHING

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this Contractor fails to coordinate with other contractors at proper time or fails to locate items properly, resulting in extra work, then this Contractor is responsible.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for work.

D. Cutting, patching, and repairing of existing (old) construction to permit installation of piping, etc. is responsibility of this Contractor. Repair or replace damage to existing work with skilled mechanics for each trade involved in a first class manner.

3.7 EXISTING SERVICES

A. Provide and install all required connections to existing systems as required by the drawings and specifications.

B. Integrate existing systems with all new work to provide a complete working system.

C. Provide minimum 48 hour notice to Owner of any service interruptions. All service interruptions shall be kept to the minimum possible time. When requested by Owner service interruptions shall occur outside of normal working hours.

D. The Contractor shall be responsible for damage to any part of the premises during the guarantee period that is caused by defects, leaks, or breaks in work furnished and/or installed under this section.

E. The Contractor shall replace refrigerant, lubricants, and/or gases lost as a result of defects, breaks, or leaks in the work.

3.8 PROJECT COMPLETION TESTS AND STARTUP

A. Upon completion of the mechanical work, or at such time prior to completion as may be determined by the Architect/Engineer, operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the building or project as a complete unit. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.

B. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. The Contractor shall notify the Architect/Engineer at least seven calendar days in advance of starting the tests listed herein.

C. Provide training and orientation of the Owner’s facilities staff in proper care and operation of equipment, systems, and controls.

D. Neatly tabulate and deliver to the Architect/Engineer complete operational data, including air flows, room temperatures, fan speeds, motor currents, plenum and duct static pressures, and other data as required. The Architect/Engineer reserves the right to spot check results, and if discrepancies or errors are noted, the Contractor will be required to redo balancing tests and tabulations entirely.

E. During the test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in a first class operating condition.

F. Mark final positions of balancing valves after balancing is complete.

G. All areas of the building shall receive proper flow of hot and chilled water to assure adequate and uniform temperatures throughout.

H. Final observation will not be conducted until all of the above requirements have been completed and the balance report has been submitted and reviewed.

3.9 TEMPORARY UTILITIES, HEATING, AND COOLING

A. Temporary utilities may be connected to the Owner's existing metered utilities only with the Owner's and the utility company's written authorization. Any connection to the Owner's existing utilities shall be separately metered to allow for proper allocation of utility costs unless another arrangement is specifically agreed to and authorized by the Owner in writing. Temporary meters shall be removed upon completion of the Work.

B. The Contractor shall be solely responsible for providing temporary heating, cooling, and/or ventilation as required to prevent degradation or damage to the Work. The permanent heating, cooling, and air handling systems shall not be utilized for the purpose of temporary heating, cooling, or ventilation until the Owner approves of such use in writing. In no case shall the permanent heating, cooling, or air handling systems be operated until they are complete, including formal startup, check out, and testing and balancing.

C. Utilization of any of the permanent heating, cooling, or air handling systems prior to the date of Substantial Completion shall not impact the specified warranty for such equipment, which shall begin on the date of Substantial Completion.

3.10 POST CONTRACT COMPLETION TESTS

A. If the required full load operation conditions cannot be conducted at the time of the 'Project Completion Tests and Startup' due to outdoor seasonal temperatures, the Contractor shall return to the job site when appropriate weather conditions arise (and/or when requested by the Architect/Engineer) to complete proper loading of equipment and systems as required. The Contractor will be allowed seven calendar days after notification to begin the tests. The Owner will be responsible for providing new air filters for the Contractor to install prior to this testing if necessary.

3.11 PRE-SEASON STARTUP

A. Within one year of filing of the Notice of Substantial Completion, when all full load tests required under 'Project Completion Tests and Startup' and 'Post Contract Completion Tests' have not yet been performed, the Contractor shall perform startup of any equipment or systems required for heating or cooling season operation when such equipment and systems have remained shut down or remain to be tested under full load. The Contractor shall ensure that all equipment and systems are operating properly before being turned over for the first operational use by the Owner. All such testing shall occur within one year of filing the Notice of Substantial Completion. The Owner will be responsible for providing new air filters for the Contractor to install prior to this testing if necessary.

3.12 WARRANTY/GUARANTEE

A. The Contractor shall be responsible for all work done and material installed under the plans and specifications. Repair or replace, as may be necessary, any defective work, material, or part which may show itself within one year of filing of the Notice of Substantial Completion and be responsible for damage to other materials, furnishing, equipment, or premises caused by such defects during this period, if in the opinion of the Architect/Engineer said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to the Owner.

3.13 ELEVEN MONTH O&M RE-TRAINING AND WARRANTY INSPECTION

A. Prior to the end of the one year warranty period (approximately 11 months after the date of the Certificate of Substantial Completion and prior to the one year warranty end date) the Contractor shall schedule a date with the Owner and the Engineer to conduct a thorough review of the mechanical systems and equipment, and provide follow-up operating and maintenance re-training (where requested by the Owner). All major Subcontractors associated with the mechanical work shall attend the operating and maintenance re-training and warranty inspection sessions. The Contractor shall video any follow-up operating and maintenance re-training that is requested by the Owner and provide electronic copies to the Owner and the Engineer. The Contractor shall take immediate action to remedy any warranty items identified during the warranty inspection, at no cost to the Owner. Provide a minimum of 14 days advance notice of the proposed date for the warranty inspection and operating and maintenance re-training sessions.

3.14 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 05 00 - BASIC MATERIALS AND METHODS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 230000 (Heating, Ventilating, and Air Conditioning) is hereby made a part of this section.

B. This section provides requirements for basic materials and methods related to all of the HVAC work. This section applies to all other Division 23 specification sections.

1.2 WORK INCLUDED

A. Types of HVAC items specified in this section include the following:

1. General Materials
2. Hangers and Supports for HVAC Systems
3. Seismic Bracing for HVAC Systems
4. Access Doors and Panels
5. Roof and Wall Flashings
6. Unions and Flanges
7. Cathodic Protection
8. Pipe Escutcheons
9. Pipe Sleeves
10. Pipe Sleeves with Mechanical Sleeve Seals
11. Penetrations in Fire and Smoke Rated Partitions and Floors
12. Piping and Equipment Identification
13. Painting
14. Concrete Work
15. Electric Motors
16. Electric Motor Starters
17. Electrical Disconnects
18. Pre-Fabricated Roof Curbs
19. Welding

1.3 PROJECT CONDITIONS

A. Existing Utilities: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of valves and piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Valve Types: Provide valves of same type by the same manufacturer.

C. Identification: Provide valves and piping specialties with the manufacturer's name or trademark and pressure rating clearly marked on the valve body.

1.5 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each type of manufactured valve and piping specialty. Include pressure drop curve or chart for each type and size of isolation valve, balancing valve, and control valve.

B. Operation and Maintenance Data: Submit operation and maintenance data and spare parts lists for each type of manufactured valve and piping specialty. Include this data and product data in the operating and maintenance manual in accordance with all associated requirements.

C. All interface requirements (BACnet or other) shall be coordinated with the temperature control system subcontractor prior to issuing submittals and/or ordering any equipment that is required to have an interface.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

A. Provide factory-fabricated valves and piping specialties as recommended by the manufacturer for use in the service indicated. Provide valves and piping specialties of types and with pressure ratings indicated for each service, or if not indicated, provide proper selections as determined by the Contractor to comply with the installation requirements. Provide sizes and connections which properly mate with pipe, tube, and equipment connections.

2.2 HANGERS AND SUPPORTS FOR HVAC SYSTEMS

A. See Specification Section 230530 (Hangers and Supports for HVAC Systems).

2.3 SEISMIC BRACING FOR HVAC SYSTEMS

A. See Specification Section 230540 (Seismic Bracing for HVAC Systems).

2.4 ACCESS DOORS AND PANELS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 22 inch by 22 inch minimum size in usable opening. Where entry of service personnel may be required, provide a 22 inch by 30 inch minimum usable opening.

B. Access doors shall match those listed in the architectural documents in all respects, except as noted herein.

C. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

D. Provide insulated access doors where located in internally insulated ducts or casings.

E. Where specific information or details relating to access panels different from the above is shown or given on the drawings or other divisions of work, then that information shall supersede this specification.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering access doors which may be incorporated in the work include Milcor, Best, or approved equal:

Milcor Style M	Drywall and/or Masonry
Milcor Style K	Plaster
Milcor Style UFR	Fire Rated (where required)

2.5 ROOF AND WALL FLASHINGS

A. Flashing for penetrations of the roof for mechanical items such as ducts, pipes, and flues shall be as indicated on the drawings and in these specifications. Where exterior sheet metal flashings are indicated on the drawings or details, the flashings shall be galvanized sheet metal. The work of this section shall include layout, sizing, and coordination of roof and wall penetrations with all trades. Flues shall have a 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.

2.6 UNIONS AND FLANGES

A. Furnish and install unions at each threaded connection to all equipment, tanks, etc. Unions shall be in accordance with the following listing:

Type of Pipe	Union
Steel pipe 2" and smaller	150 lb threaded malleable ground joint, brass to iron seat, black for black piping, galvanized for galvanized piping.
Steel pipe 2-1/2" and larger	125 lb cast iron threaded flanged union, flat faced, gasket, black for black piping, galvanized for galvanized piping.
Copper tubing 2" and smaller	150 lb bronze ground joint, bronze to bronze sweat connection.
Copper tubing 2-1/2" and larger	150 lb cast bronze, flat faced flange with silver brazing threadless ends.

B. Insulating couplings or flanges shall be furnished and installed at all connections of piping with dissimilar materials. Construct couplings so that the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Heavily line the couplings with a hard, insulating, phenolic threaded coupling in standard pipe sizes.

C. Furnish and install flanges at each flanged connection to equipment, tanks, and valves per the following schedule:

Type of Pipe	Flanges
Threaded black or galvanized steel pipe 2-1/2" and larger	125 lb threaded cast iron, flat face flange, black or galvanized steel as applicable.
Welded steel pipe 2-1/2" and larger	150 lb welded forged steel, raised face flange.

D. Provide full faced or ring type gasket material to suit facing on flanges. Gasket material shall be 1/16" thick Garlock Blue-Gard, or approved equal. Gasket material shall be suitable for the connected piping system content and temperature.

2.7 PIPE ESCUTCHEONS

A. Provide chrome plated brass pipe escutcheons with inside diameter closely fitting pipe outside diameter or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, ceilings, or pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish and screw or spring clamping device with concealed hinge.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe escutcheons which may be incorporated in the work include the following, or approved equal:

Chicago Specialty Manufacturing Company
Producers Specialty and Manufacturing Corporation
Sanitary Dash Manufacturing Company

2.8 PIPE SLEEVES

A. Where pipes pass through exterior walls above grade and/or through concrete floors install a Schedule 10 galvanized metal sleeve providing between a 1/2” and 1” clearance around the sides of the pipe. The pipe shall be covered with high density fiberglass insulation. Pipe insulation shall be 1/2” to 1” thick Johns Manville Microlok HP or Johns Manville Trymer 25-50 for the full thickness of the concrete. After the piping has been installed, the fiberglass insulation shall be cut away or compressed leaving a 1/2” deep space that shall then be filled with a high quality silicone sealant resulting in a flat, water-tight installation.

B. Where pipes pass through fire rated walls above grade or fire rated concrete floors install a Schedule 10 galvanized metal sleeve providing between a 1/2" and 1" clearance around the sides of the pipe and/or pipe insulation for the full thickness of the concrete. After the piping has been installed, fill the annular space with a 3M sealant in accordance with the applicable UL fire rating system.

2.9 PIPE SLEEVES WITH MECHANICAL SLEEVE SEALS

A. Provide mechanical sleeve seals for pipe sleeves located in foundation walls below grade and/or in exterior walls below grade as follows:

1. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing a water-tight seal.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe sleeves with sleeve seals which may be incorporated in the work include the following, or approved equal:

   Thunderline Link-Seal
   Calpico

2.10 PENETRATIONS IN FIRE AND SMOKE RATED PARTITIONS AND FLOORS

A. Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe, conduit, and duct penetrations. Seal all penetrations with fire-stop and smoke-stop materials complying with the requirements for firestopping and fill materials specified in this section.

B. Schedule and conduct a firestopping pre-installation conference at the job site. Coordinate all firestopping means and methods with other contractors and the general contractor (when applicable) prior to beginning any work.

C. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 (Approval of Firestop Contractors), or been evaluated by UL and found to comply with their 'Qualified Firestop Contractor Program Requirements'.

D. Install all penetration firestopping systems to comply with the manufacturer's written installation instructions and published drawings for products and applications.

E. Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by the penetration firestopping system manufacturer or when substrates are wet because of rain, frost, condensation, or other causes.

F. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilation, or where this is inadequate, forced-air circulation.

G. The specified firestopping systems are based on a solid sealant only, or combinations of solid sealant, foam sealant, and refractory fibers of thickness required to attain hour ratings.

H. Fire and Smoke Partition Systems shall comply with the following:

1. Provide a flexible seal to prevent passage of fire, smoke, toxic gases, and water through openings, and prevent transmission of sound and vibration from the penetrating element to the structure.

2. Provide hour ratings indicated and in accordance with ASTM E814 and/or UL 1479.

3. For projects located in the State of California comply with requirements of CBC Sections 709.6, 709.7, 709.8, 710.2, 710.3 and 710.6, and CBC Standards 7-1 and 7-5.

I. Acceptable Manufacturers: 3M, Hilti, SpecSeal, Nelson, HoldRite, Tremco, Roxtec, or approved equal. The established standard in most cases is 3M, unless otherwise specified. The listed products are specified to establish standards and the type of materials required. Materials shall be as specified, or approved equal.

J. Sealant: Select among the following materials as appropriate.
   1. Solid (Elastomeric): 3M Fire Barrier Premium Latex CP 25WB+ Caulk, one-component elastomeric water-based latex sealant designed for use as a through-penetration firestop
   2. Foam: 3M Fire Barrier 2001 Silicone RTV Foam, two-component silicone elastomer foam-in-place sealant designed to fill irregular or complex voids.
   3. Wrap Strip: 3M Fire Barrier FS-195+ Wrap Strip, fire resistive strip designed to be wrapped around the penetrating item and secured in place.
   4. Restricting Collar: 3M Fire Barrier RC-1 Restricting Collar, sheet metal, designed for use with wrap strip in combustible through-wall firestop penetration systems.
   5. Composite Sheet: 3M Fire Barrier CS-195+ Composite Sheet, elastomeric layer reinforced with mesh restraining wire and covered with aluminum foil on one side and bonded to sheet metal, forming a fire resistive sheet.
   6. Putty: 3M Fire Barrier MP Moldable Putty+ Pads and Sticks, one-component elastomeric formable putty, designed for use as a through-penetration firestop system.
   7. Spray: 3M FireDam Spray 100, flexible water-based coating.
   8. Primers: As recommended by the sealant manufacturer.

K. Pillows: Nelson PLW Firestop Pillow, Hilti FS Fire Block, dust proof chemical resistant cloth with heat-reactive expanding solidifying fill, designed for large openings that require frequent cable alterations.

L. Safing Insulation: USG Thermafiber Safing Insulation, 4 lb density mineral wool insulation, unless indicated otherwise.

M. Damming Materials: As recommended by the firestopping manufacturer.

2.11 PIPING AND EQUIPMENT IDENTIFICATION

A. Each piping system furnished and installed under this work shall be identified and the direction of flow indicated by means of colored labels and flow arrows, all as specified herein. The labels shall be applied after all painting, priming, and cleaning of the piping and insulation is completed.

B. Provide prefabricated coiled plastic piping labels as manufactured by Marking Services Incorporated (MSI), or approved equal. Labels shall comply with the most current edition of ANSI/ASME Standard A13.1 with regard to color, letter height, and marker size. The labels shall have black or white lettering and flow arrows on colored backgrounds and shall not require adhesive. The background colors shall conform to the color schedule included in the 'Execution' section of this specification.
   1. For pipe labels used indoors use coiled polyester labels, MSI Model MS-975, or equal.
   2. For pipe labels used outdoors use coiled polyester labels, MSI Model MS-995, or equal.
   3. For piping with an outside diameter, including insulation, greater than 6 inches provide the label manufacturer's nylon straps to secure label to piping. Labels shall lie smoothly against pipe or insulation completely around the pipe.
   4. The size of the lettering and label shall be such that the lettering can be easily read from the floor and the colors shall be easily discernible.

C. Provide a white plastic lamacoid plate for each and every piece of equipment installed in this work. Lettering on plate shall be black, with size of lettering to suit equipment. Lettering shall be a minimum of 1/2 inch in height. Plates shall be riveted or bolted to equipment near electrical disconnect or control access panel.

D. Where mechanical or plumbing equipment requiring access is located above a ceiling or behind an access panel, provide an adhesive clear plastic label with 3/8" black lettering on the ceiling grid or access panel identifying the equipment.

E. Ground loop circuit piping inside a mechanical room shall be labeled to coincide with the numbering indicated on the mechanical drawings.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following, or approved equal:

Marking Services Incorporated (MSI)
LEM Products
Seton
Craftmark

2.12 PAINTING

A. In general, painting will be done by others. Exposed piping and unfinished portions of equipment to be painted shall be cleaned by this Contractor of grease, oil, rust, or dirt in preparation for painting. Spot prime all factory primed surfaces as necessary.

2.13 CONCRETE WORK

A. Where specifically indicated on the drawings or specified as part of the mechanical work, this Contractor shall furnish and install concrete work such as thrust blocks and/or spring isolator bases.

B. Concrete and reinforcing steel shall be equal to that specified for general construction.

C. Except as noted above, concrete work will be furnished and installed by others. This Contractor shall coordinate all requirements accordingly.

2.14 ELECTRIC MOTORS

A. Electric motors larger than 1/2 horsepower rating, unless otherwise noted, shall be ball bearing, open drip proof, squirrel cage, induction type, normal starting torque, 3 phase, 60 cycle service, 40°C continuous rating, and shall conform in all respects to latest applicable standards of NEMA and AIEE. Motors shall be Century, Louis Allis, Baldor, or equal. Motors located outdoors shall be TEFC type.

B. All motors 1 horsepower and above shall be premium efficiency type, Century E-Plus, or approved equal.

C. Motors utilized with variable frequency drives shall be rated as inverter duty per NEMA standards.

D. Motors shall have nameplate voltage rating of operating voltage specified in subsequent sections of specifications or as shown on drawings and shall have a 1.15 service factor.

E. For normal applications, motors shall be furnished for normal starting torque duty. It shall be this Contractor's responsibility, however, to provide motors and starters (where starters are furnished under this section) having suitable starting torque and current characteristics to allow starting the equipment within the branch circuit protection provided and within the overload protection required by code.

F. Splash-proof or totally enclosed motors having a continuous duty temperature rise rating not exceeding 35°C shall have adequate starting torque, as recommended by the manufacturer, for the service intended.

G. All motors shall be rated at $\pm$10% of the scheduled voltage. If not, provide each motor with a boost transformer sized for the intended use and installed in a rated enclosure.

1. Boost transformers for equipment provided under the mechanical work shall be furnished by the mechanical contractor and turned over to the electrical contractor for installation, unless otherwise noted.

H. Shaft Grounding

1. All variable frequency drive motors less than 300 horsepower shall have a single shaft grounding system to protect the bearings from capacitive discharge through the bearings.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following, or approved equal:

   CR Series by Shaft Grounding Systems
   AEGIS SGR Conductive Microfiber Brush

2.15 ELECTRIC MOTOR STARTERS

A. Magnetic motor starters for equipment provided under the mechanical work shall be furnished by the mechanical contractor and turned over to the electrical contractor for installation, unless otherwise noted. All motor starters shall be by the same manufacturer, Westinghouse, Square D, Cutler-Hammer, General Electric, or approved equal.

B. Magnetic motor starters provided as part of motor control centers shall be provided and installed by the electrical contractor.

C. Unless otherwise noted, magnetic motor starters shall be furnished in a NEMA 1 enclosure for inside installation and in a gasketed NEMA 4 enclosure for outside installation, with three thermal overloads for three phase motors and one overload element for single phase motors. All overloads shall be ambient compensated.

D. Submit schedule to the Architect/Engineer denoting the following:

1. Designation of each motor
2. Name plate rating of each motor
3. Running current of each motor
4. Catalog number and rating of starter overload elements
5. Circuit breaker trip size (when in combination starter)

E. Combination magnetic starters shall be Westinghouse Type A206 with circuit breaker disconnect and trip size of breaker as required for motor size, or as otherwise noted.

F. Magnetic motor starters shall be Westinghouse Type A200, or approved equal.

G. Manual motor starters shall be Westinghouse Type MST01 less enclosure, or approved equal.

H. Magnetic motor starters shall be provided with cover-mounted Hand-Off-Auto ‘Oil-Tight’ type switches as scheduled, with integral fused 120 volt control transformer.

2.16 ELECTRICAL DISCONNECTS

A. The short circuit current rating (SSCR) of each integral or factory-furnished disconnect switch provided by Division 23 shall match or exceed the SSCR of the source panel or distribution board. Coordinate with Division 26 for the results of the Short Circuit Studies required in the Division 26 specifications prior to release of order(s) for disconnects. This requirement applies to all electrical disconnects, including but not limited to, disconnects for chillers, boilers, variable frequency drives, air handling units, rooftop units, condensing units, etc.

2.17 PRE-FABRICATED ROOF CURBS

A. Provide manufacturer's standard shop-fabricated units, modified if necessary, to comply with project requirements. All roof curbs shall be secured to the roof support structure.

B. All roof curbs shall be modified when necessary using pressure-treated tapered wood at the top of the support units to form a level top edge.

C. Roof curbs for equipment weighing over 400 lbs shall be seismically designed and rated, with seismic calculations prepared by a Nevada licensed structural engineer, based on an Importance Factor of 1.0, except for critical buildings or applications which require a higher Importance Factor based on the specific application.

D. The roof curb height listed on the drawings indicates the minimum height of the curb at the lower end of the roof slope. The Contractor is responsible for confirming the roof insulation assembly depth on the architectural drawings in order to determine the actual required height of each roof curb. All roof curbs shall be constructed such that the top of the curb is a minimum of 14 inches above the lowest point of the finished roof surface. For most applications the roof thickness is approximately 8 inches, resulting in a total curb height of 22 inches. Verify actual height with the architectural plans.

E. Fabricate structural framing for units of structural quality sheet steel formed to manufacturer's standard profiles for coordination with roofing, insulation, and deck construction. Include 45 degree cant strips and deck flanges with offsets to accommodate roof insulation. Weld corners and seams to form water-tight units.

F. Where roof curb metal gauge is not indicated fabricate units of 14 gauge metal.

G. Provide a pressure-treated wood nailer, not less than 1-5/8" thick and of not less than the width of the metal support wall assembly. Anchor nailer securely to top of metal frame unit.

H. Field-install rigid insulation inside the roof curb assembly on all four sides and on the bottom of the roof curb. Insulation shall have a minimum insulating valve of R-11.4. See mechanical equipment curb detail(s) on the drawings for additional information and requirements.

I. Available Manufacturers: Subject to compliance with requirements, manufacturers offering prefabricated seismic roof curbs which may be incorporated in the work include the following, or approved equal:

Same Manufacturer as Equipment
MicroMetl
Thybar

2.18 WELDING

A. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M (Structural Welding Code - Steel).

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code Section IX. Comply with ASME B31.9 (Building Services Piping) for materials, products, and installation.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Perform excavation required for installation of piping, service lines, and other work as indicated on the drawings. Verify location and elevation of all existing utilities prior to excavation for installation of new piping.

B. Excavations shall be of open vertical construction of sufficient width to provide free working space at both sides of the trench and around piping as required for joining, caulking, backfilling, and compacting.

C. Where invert elevations are not shown, dig trenches in accordance with the following:

Exterior Water Piping (36 inches minimum cover)
Gas Piping (18 inches minimum cover)

D. Dig trenches straight and true to line and grade with holes for bells for bell-and-spigot pipe. Evenly support piping for its entire length upon outside periphery of lower one third of pipe.

E. Where rock is encountered, undercut trenches by 3 inches, and fill with well tamped clean sand or pea gravel as required to correct pipe elevation.

F. After piping in the excavation has been installed and tested, backfill excavation to a point 6 inches above the piping using utility sand or pipe sand that is free of rocks and debris. Proceed evenly on both sides of the pipe and continuously tamp. Except as hereinafter noted, backfill more than 6 inches above the top of the pipe shall be made by using earth from the excavation placed in layers of 6 inch maximum depth. Compaction of each successive layer shall be achieved using a mechanical compactor. See drawings and trench details for additional requirements.

G. Special care shall be taken when backfilling over and around wrapped or pre-insulated piping to prevent damage to the protective wrapping and/or insulation.

H. Any backfill which subsides or settles below the adjacent finished grade or paving level during the guarantee period shall be brought to grade by the Contractor by adding compacted backfill or additional paving in paved areas.

I. See trench detail(s) on the drawings for additional information and requirements.

3.2 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole and is flush with adjoining surface.

B. Sleeves: Secure sleeves to metal or wood forms in such a manner that they will not become displaced during pouring of concrete. Fill sleeves on deck with sand. After forms have been removed from concrete, the sleeves shall be removed from the openings.

C. Core drill properly sized holes in the concrete to replace metal sleeves that are crushed or knocked out of position during pouring of concrete.

D. Provide piping passing through concrete fire walls with sleeves of standard black steel pipe nominally one size larger than pipe enclosed, but in the case of insulated pipe, large enough for insulation to pass through. Caulk space between pipe and sleeve with fire rated wicking, and provide metal retainer plates at both sides of the wall.

3.3 INSTALLATION OF WYE STRAINERS

A. Install low pressure wye strainers shall be full size of the connected piping in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in the strainer blowdown connection, full size of connection, except for strainers 2 inches and smaller installed ahead of control valves feeding individual equipment. Where indicated, provide a drain line from the shutoff valve to the nearest plumbing drain, same size as the blowdown connection.

B. Locate strainers in the supply line ahead of the following equipment and elsewhere as appropriate, if an integral strainer is not included in the equipment:

Pumps
Temperature and/or flow control valves
Pressure reducing valves
Temperature and/or pressure regulating valves

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Section 230530 (Hangers and Supports for HVAC Systems).

B. Where special hanger/support of piping or ductwork is detailed or shown on the drawings, the drawings shall be followed.

3.5 INSTALLATION OF VALVES

A. See Specification Section 230510 (Valves for HVAC Systems).

3.6 INSTALLATION OF UNIONS AND FLANGES

A. Install unions and flanges so that piping can be easily disconnected for removal of tanks, equipment, and valves. Also see Specification Section 230510 (Valves for HVAC Systems).

3.7 INSTALLATION OF CATHODIC PROTECTION

A. Install dielectric unions in the following locations:
   1. At points in piping where dissimilar metal pipes are connected together.
   2. Any special applications shown on the drawings.

3.8 INSTALLATION OF PIPE IDENTIFICATION

A. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.

B. The legend and flow arrow shall be applied at all valve locations, at all points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction, and at approximately 20 foot intervals on pipe runs.

C. Practical variations or changes in locations and spacing may be made with the specific approval of the Architect/Engineer to meet specific conditions.

D. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.

E. Markings shall be located to be conspicuous from any reasonable vantage point.

F. The legends and flow arrows shall be in the colors as indicated in the pipe marking schedule.

G. Pipe labels shall be as described in Section 2.20 of this specification (Piping and Equipment Identification).

H. Pipe Marking Schedule (Based on ANSI/ASME Standard A13.1-2023)

Service	Color
Refrigerant Piping (ASHRAE Class A1)	White Text on Black Background
Refrigerant Piping (ASHRAE Class A2L)	Black Text on Yellow Background

I. Where different equipment such as fire sprinklers are supplied from a common main, such as a domestic water main, the main should be identified as ‘Domestic Water’ and each respective branch takeoff as ‘Fire Water’, etc.

J. Legacy Identification Schemes (Existing Facilities and Renovation Work): In existing facilities where the piping identification was previously labeled based on an earlier edition of ANSI/ASME Standard A13.1 (including the 1996 edition or the 2020 edition), the existing color scheme may be continued for renovation, alteration, and tenant improvement work, in accordance with the most current edition of ANSI/ASME Standard A13.1, provided that both of the following conditions are met:
   1. The existing scheme is described in writing and made available to building operation and maintenance personnel, or affected employees are trained on the operation and hazards of the piping systems; and

2. The existing scheme is applied consistently throughout the affected systems within the facility. Where new piping systems are introduced into an existing facility under this work, the new piping shall be labeled in accordance with the existing facility scheme to maintain consistency, and the Contractor shall coordinate with the Owner to confirm the applicable scheme prior to ordering labels.

3.9 INSTALLATION OF AIR VENTS

A. Install air vents in hydronic systems at all high points and as required to adequately bleed all air from the piping systems and equipment during initial filling, normal operation, and subsequent filling of each piping system.

B. Install air vents in steam and condensate systems at all high points and as required to adequately bleed all air from the piping systems and equipment during initial filling, normal operation, and subsequent filling of each piping system. Air vents for steam systems shall be balanced pressure type, Spirax Sarco Model VS-204, or approved equal by Armstrong.

3.10 DEMOLITION WORK

A. Demolition work shall be performed only where specifically identified on the drawings. Unless specifically indicated otherwise, demolition work shall include removal of all associated equipment, electrical and controls components, conduit and wiring, piping, valves and accessories, and supports. The surfaces where the demolition work was performed shall be restored to match the adjacent surfaces to the best extent practical.

B. When demolition work involves leaving existing systems in place for a prolonged time period (more than 30 days and/or any time period when there is the potential for freezing temperatures) the Contractor shall protect all existing equipment, piping, and ductwork from potential damage during the time that the equipment, piping, and ductwork is out of service.

C. The protection procedures shall include draining all hydronic coils and the associated piping systems that may be susceptible to freezing temperatures when the building heating system is disabled.

D. The protection procedures apply to both hydronic piping and domestic water piping systems. After the piping systems are drained, the Contractor shall purge all water from the hydronic coils, hydronic piping systems, and domestic water piping systems using compressed air or other appropriate means, and shall seal any open ends such that the potential for corrosion is minimized. This work shall be performed by an experienced mechanical or plumbing contractor, rather than by a demolition contractor.

3.11 FORMING, CUTTING, AND PATCHING

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this Contractor fails to coordinate with other contractors at the proper time or fails to locate items properly, resulting in extra work, the Contractor is responsible for the additional work, at no cost to the Owner.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for all work.

D. Cutting, patching, and repairing of existing (prior) construction to permit installation of piping, conduit, etc. is the responsibility of the Contractor. Repair or replace any damage that occurs to existing work in a first class manner using skilled mechanics for each trade involved.

E. Cut existing construction in a neat and workmanlike manner by the use of a concrete saw. Use of pneumatic devices is not acceptable.

F. Core openings through existing construction as required for the passage of any new piping and/or conduit. Cut holes of the minimum diameter required to suit the size of the pipe to be installed, including the associated insulation.

G. In any case where it is necessary to disturb or remove structural fireproofing the Contractor shall be responsible for restoring the fireproofing to match the original condition. Fireproofing restoration shall be performed by a properly trained and licensed contractor.

3.12 ELECTRICAL WORK

A. Adequate working space shall be provided around electrical equipment in compliance with the National Electrical Code and other applicable codes. Mechanical work shall be coordinated with the electrical work in order to comply with these requirements. Any work which does not conform to these requirements shall be corrected without additional cost to the Owner.

B. Furnish and install all line and low voltage temperature control wiring in the mechanical work (typically furnished and installed by the temperature control subcontractor) including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Unless noted otherwise, this does not include primary control wiring between starters and pushbuttons, other manual starter switches, or branch power circuits required for the temperature control system.

C. Electrical Coordination
   1. Starters located in motor control centers will be provided under the electrical work. The Contractor is referred to electrical drawings for motors served by motor control centers.
   2. Motors furnished under the mechanical work shall be furnished by the mechanical contractor, but connection to power wiring shall be by the electrical contractor. Coordinate all motor starter requirements with the electrical contractor.
   3. Temperature control equipment, including relays shown on control diagram, shall be furnished and installed by the temperature control subcontractor.
   4. Electrical devices with piping connections, such as solenoid valves, insertion thermostats, strap-on aquastats, and similar items which are to be wired under the electrical work or by the temperature control subcontractor, shall be installed by the mechanical contractor.

D. Equipment furnished in this work that is factory wired but requires modification to internal wiring to meet specifications or drawing requirements shall have such internal modifications made at the factory before shipment.

E. All electrical work and equipment, including internal wiring, shall comply with applicable codes and applicable portions of the electrical specifications. Route line and low voltage control wiring in conduit. Conduit for temperature control wiring shall be the responsibility of the mechanical contractor and shall be of the type specified in Division 26.

3.13 POST-CONSTRUCTION OWNER TRAINING

A. In addition to the Owner training requirements listed in all other specification sections, the Contractor shall provide an overall comprehensive training session one month prior to the one year warranty expiration date. This session is intended to address any and all questions that the Owner’s facility staff may have with regard to operation and maintenance of all of the installed mechanical systems.

3.14 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.15 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.16 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 05 20 - OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Furnish the Architect/Engineer with two complete sets of typewritten operating and maintenance instructions, descriptive literature, catalog cuts, and diagrams covering all items of operation and maintenance for each and every mechanical system and piece of equipment furnished under these specifications.

B. In addition to the bound hard copies the Contractor shall provide an electronic copy (pdf file).

C. The Contractor shall begin compiling the above data (including obtaining operating and maintenance instruction data, catalog cuts, and diagrams from the manufacturer of the reviewed equipment) immediately upon review of his list of materials, so as not to delay the final installation and acceptance of the work.

D. Bind and index each set in a durable, hardboard binder. Final observation should not be requested until the operating and maintenance binders are submitted and have been reviewed by the Architect/Engineer.

E. Incorporate complete operating instructions including starting, stopping, and description of emergency manual operation methods for the following:

1. Heating Systems
2. Ventilating Systems
3. Air Conditioning Systems
4. Piping Systems
5. Temperature Control Diagrams
6. Test Data and Startup Reports

F. Provide charts and diagrams as required.

G. Provide operating manuals for all equipment listed in individual sections of the specification.

H. Provide maintenance instructions for each item of individual equipment covering pertinent maintenance data, such as lubricants to be used, frequency of lubrication, inspections required, adjustments required, etc.

I. The Contractor shall video the operating and maintenance instruction sessions for all major items of equipment. The separate videos shall be of reasonable content and quality.

J. Provide parts bulletins containing manufacturer's part numbers, instructions, etc. for each item of equipment. Strip bulletins so that useless bulk is avoided.

K. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect/Engineer or Owner.

END OF SECTION

SECTION 23 05 30 - HANGERS AND SUPPORTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 230000 (Heating, Ventilating, and Air Conditioning), Section 230500 (Basic Materials and Methods for HVAC Systems), and Section 230540 (Seismic Bracing for HVAC Systems) are hereby made a part of this section.

1.2 GENERAL

A. The following information is for pipe hanger and support layout and design reference only. The actual design of all hangers, supports, and seismic bracing is the responsibility of the Contractor per the following specification sections:

Specification Section 23 05 30 (Hangers and Supports for HVAC Systems)
Specification Section 23 05 40 (Seismic Bracing for HVAC Systems)

B. Piping: Hangers and supports for piping shall be designed in accordance with the latest adopted edition of the standards and codes listed below, and with any other applicable standards. Except in cases where a pipe stress analysis is performed to justify adjusted support and restraint spacing, pipe hangers and supports shall not be placed at intervals that are further apart than the requirements listed in UPC Table 313.3 and in UMC Table 313.3.

Steel Piping	Maximum Spacing	Reference
1-1/4” and smaller	7 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/2”	9 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2”	10 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2-1/2”	11 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3”	12 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3-1/2”	13 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
4”	14 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
5”	16 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
6”	17 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
8”	19 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
10”	22 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
12”	23 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
14”	25 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
Copper Piping	**Maximum Spacing**	**Reference**
3/4” and smaller	5 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1”	6 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/4”	7 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
1-1/2”	8 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2”	8 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
2-1/2”	9 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3”	10 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
3-1/2”	11 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
4”	12 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
5”	13 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
6”	14 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
8”	16 feet	ANSI/MSS SP-69 & SP-58 Tables 3 & 4
Gas Piping	**Maximum Spacing**	**Reference**
1/2”	6 feet	International Fuel Gas Code
3/4” & 1”	8 feet	International Fuel Gas Code
1-1/4” and larger	10 feet	International Fuel Gas Code

C. Ductwork: Hangers and supports for rectangular and round ductwork shall be designed in accordance with the latest adopted edition of the SMACNA HVAC Duct Construction Standards. Vertical duct supports shall also be designed in accordance with the latest adopted edition of the SMACNA HVAC Duct Construction Standards. Note that the SMACNA HVAC Duct Construction Standards require that duct hangers also be installed within 2 feet of duct elbows and within 4 feet of duct branch fittings.

D. Rectangular Ducts: Maximum spacing and strap and/or hanger rod sizes shall be in accordance with SMACNA HVAC Duct Construction Standards Table 4.1.

E. Round Ducts: Maximum spacing and strap and/or hanger rod sizes shall be in accordance with SMACNA HVAC Duct Construction Standards Table 4.2.

1.3 SUMMARY

A. This section includes the following:
   1. Metal Pipe Hangers and Supports
   2. Thermal Hanger Shield Inserts
   3. Fastener Systems
   4. Pipe Stands
   5. Ductwork Supports
   6. Equipment Stands
   7. Equipment Supports

B. Related Requirements: All hangers and support systems shall be designed, selected, and installed by the Contractor to comply with the requirements listed in Section 230540 (Seismic Bracing for HVAC Systems).

C. Costs for hanger, support, and seismic bracing systems complying with the requirements listed herein are the responsibility of the Contractor and shall be included in the Contractor's bid. No extra cost will be allowed for failure to include the associated costs in the Contractor's bid.

D. In no case shall hangers and/or supports for HVAC piping, ductwork, or equipment be attached to a metal roof deck, unless provisions or allowances are explicitly shown on the structural drawings.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for the following (Include product data for all components):
   1. Metal Framing (Strut) Systems
   2. Trapeze Pipe Hangers
   3. Pipe Stands
   4. Ductwork Supports
   5. Equipment Supports

C. Delegated Design Submittals: Provide comprehensive, all-inclusive, delegated design submittals for all listed items. Submittals shall comply with all performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Details for fabrication and assembly of trapeze hangers.
   2. Design calculations utilized for designing the trapeze hangers.
   3. Design details and calculations for ductwork and equipment supports.

D. The work of this section shall be coordinated with the requirements for the Contractor furnished seismic design submittal for hangers and supports specified in Section 230540 (Seismic Bracing for HVAC Systems). Design and detailing of seismic bracing, hangers, and supports is the responsibility of the Contractor.

E. Submittals shall be fully coordinated with the structural drawings and shall include all applicable structural and seismic attachment details. Locations and the methods of attachment of hangers and supports to the main structural frame shall comply with the limitations specified in the structural drawings.

F. Submittals shall include all support anchorage loads and vectors broken out by discrete load type. Each specific load shall be indicated in the submittals and the structural element that the support is attached to shall be clearly depicted/identified.

G. Shop drawing submittals will be reviewed by both the design mechanical engineer and the design structural engineer (structural engineer when applicable).

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M (Structural Welding Code - Steel).

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Where required, engage a licensed professional engineer (licensed in the state where the project is located), to design trapeze pipe hangers/supports, ductwork hangers/supports, & equipment hangers/supports.

B. Structural Performance: Hangers and supports for HVAC piping, ductwork, and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE Standard 7-16.

1. Design hangers/supports for piping, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design hangers/supports for ductwork and associated accessories.
3. Design equipment hangers/supports capable of supporting combined operating weight of supported equipment, including connected systems and components.
4. Design seismic restraint hangers and supports for piping, ductwork, and equipment. See Section 230540 (Seismic Bracing for HVAC Systems).
5. Design of connections for hangers, supports, and bracing shall comply with the requirements indicated on the structural drawings.

2.2 GENERAL MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers shall be same or similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory mixed and packaged, dry hydraulic cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.
   1. Properties: Non-staining, non-corrosive, and non-gaseous.
   2. Design Mix: 5,000 psi, 28 day compressive strength.

2.3 HVAC EQUIPMENT HANGERS AND SUPPORTS

A. Provide delegated design as applicable for the specific equipment.

2.4 DUCTWORK HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electro-galvanized, all-thread rods, or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Table 5-1 (Minimum Hanger Sizes for Rectangular Ducts) and Table 5-2 (Minimum Hanger Sizes for Round Ducts).

D. Steel Cables for Galvanized Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cables for Stainless Steel Ducts: Stainless steel complying with ASTM A492.

F. Steel Cable End Connections: Galvanized steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports
   1. Supports for Galvanized Steel Ducts: Galvanized steel shapes and plates.
   2. Supports for Stainless Steel Ducts: Stainless steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.5 HVAC PIPE HANGERS AND SUPPORTS

A. Carbon Steel Pipe Hangers and Supports
   1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
   2. Galvanized Metallic Coatings: Pre-galvanized, hot dip galvanized, or electro-galvanized.
   3. Non-Metallic Coatings: Plastic coated or epoxy powder coated.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support the bearing surface of the piping.
   5. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

B. Stainless Steel Pipe Hangers and Supports
   1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   3. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

C. Copper Pipe and Tube Hangers
   1. Description: MSS SP-58, Types 1 through 58, copper plated steel, factory fabricated components.
   2. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.

2.6 HANGER AND SUPPORT MATERIALS

A. Additional hanger and support requirements are listed in sections specifying piping, ductwork, and equipment.

B. Comply with MSS SP-58 for pipe hanger selections and applications that are not specified in piping system sections.

C. Use hangers and supports with galvanized metallic coatings for piping, ductwork, and equipment that will not have field applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger shield inserts for insulated piping and tubing.

I. Horizontal Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes 1/2” thru 30” size.
2. Yoke Type Pipe Clamps (MSS Type 2): For suspension of up to 1050°F, pipes 4” thru 24” size, requiring up to 4 inchesof insulation.
3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes 3/4” thru 36” size, requiring clamp flexibility and up to 4 inchesof insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes 1/2” thru 24” size if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes 1/2” thru 4” size, to allow off center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split or Solid Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes 3/4” thru 8” size.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
9. Adjustable, Swivel Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes 1/2” thru 8” size.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes 3/8” thru 8” size.
11. Extension Hinged or Two Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes 3/8” thru 3” size.
12. U-Bolts (MSS Type 24): For support of heavy pipes 1/2” thru 30” size.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes 4” thru 36” size, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes 4” thru 36” size, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion type support for pipes 2-1/2” thru 3” size, 6” size if vertical adjustment is required, with steel pipe base stanchion support and cast iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes 1” thru 3” size, from two rods if longitudinal movement caused by expansion and contraction may occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes 2-1/2” thru 24” size, from single rod if horizontal movement caused by expansion and contraction may occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2” thru 42” size if longitudinal movement caused by expansion and contraction may occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes 2” thru 24” size if small horizontal movement caused by expansion and contraction may occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes 2” thru 30” size if vertical and lateral adjustment during installation may be required in addition to expansion and contraction.

J. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers 3/4” thru 24”.
   2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers 3/4” thru 24” size if longer ends are required for riser clamps.

K. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inchesfor heavy loads.
   2. Steel Clevises (MSS Type 14): For 120°F to 450°Fpiping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120°F to 450°Fpiping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
   6. C-Clamps (MSS Type 23): For structural shapes.
   7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
   8. Side Beam Clamps (MSS Type 27): For bottom of steel I-beams.
   9. Steel Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
   10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lbs.
    b. Medium (MSS Type 32): 1,500 lbs.
    c. Heavy (MSS Type 33): 3,000 lbs.
13. Side Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Steel Pipe Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Restraint Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary, to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe hanger selections and applications that are not specified in piping system sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system sections.

Q. Use powder actuated fasteners and mechanical expansion anchors instead of building attachments where required in concrete construction.

2.7 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop or field fabricated pipe support assembly made from structural carbon steel shapes with MSS SP-58 carbon steel hanger rods, nuts, saddles, and U-bolts.

2.8 METAL FRAMING (STRUT) SYSTEMS

A. Metal Framing Manufacturers Association (MFMA) Metal Framing Systems

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

   B-line
   Unistrut
   Flex-Strut
   G-Strut
   Miro Industries

2. Description: Shop or field fabricated, pipe support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory fabricated components for field assembly.
4. Channels: Continuous slotted carbon steel channel with in-turned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous thread rod, nuts, and washers made of carbon steel.
8. Metallic Coating: Zinc dichromate finish applied over an electro-galvanized zinc plating.

2.9 THERMAL HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:
   Pipe Shields
   nVent/Caddy
   Buckaroos

B. Standard Insulation Insert Material for Cold Piping: Polyisocyanurate high density insulation, with 125 psiminimum compressive strength, a flame spread/smoke developed rating of 25/50 or less, and vapor barrier.

C. Standard Insulation Insert Material for Hot Piping: Polyisocyanurate high density insulation, with 125 psiminimum compressive strength, a flame spread/smoke developed rating of 25/50 or less; or calcium silicate with 100 psiminimum compressive strength.

D. Structural/Seismic Insert Material for Cold Piping: Polyisocyanurate high density insulation, with a minimum density of 14 lbs/ft^3, a minimum compressive strength of 900 psi, and a flame spread/smoke developed rating of 25/50 or less. Structural inserts shall be used as recommended by the insert manufacturer to meet load ratings.

E. Structural/Seismic Insert Material for Hot Piping: Calcium Silicate with a minimum density of 28 lbs/ft^3 and a minimum compressive strength of 900 psi. Structural inserts shall be used as recommended by the insert manufacturer to meet load ratings.

F. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

G. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

H. Insert Length: Extend 2 inchesbeyond sheet metal shield for piping operating below ambient air temperature.

I. Provide a vapor barrier steel jacket around insulation. Insulation jackets shall be galvanized steel conforming to ASTM A653. Hanger bearing surface shall consist of a galvanized sheet metal insulation protection shield or casing.

J. Thermal hanger supports shall be load rated. Load ratings shall be established by the pipe support manufacturer based upon testing and analysis in conformance with the current edition of following codes and standards: ASME B31.1, MSS SP-68, SP-69, and SP-89.

K. Unless otherwise indicated, thermal hanger supports shall be as indicated in the following schedule, or approved equal. The listed model numbers are based on Pipe Shields.
   1. Pipe supported on hangers: Models A2000, A4000, A9000, and D3000 series.
   2. Pipe supported on flat surfaces: Models A2000, A4000, A6000, A7000, A7200, and A7400.
   3. Pipe Supported on pipe rolls: Models A4000, A6000, A8200, and A8400.
   4. Pipe supported on slides and guides: Model B series.
   5. Riser pipe supports: Model E series.

L. The selected model(s) shall conform to pipe service, support style, and support spacing.

M. Pipe support spacing shall be in accordance with the manufacturer's recommendations, but in no case shall exceed the maximum spacing required by ASME B31.1.

2.10 FASTENER SYSTEMS

A. Powder Actuated Fasteners: Threaded steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Powder actuated fasteners may only be utilized for point loads of 50 lbs or less.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Hilti
      ITW Ramset (Red Head)
      Simpson Strong-Tie

B. Mechanical Expansion Anchors: Insert wedge type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated stainless steel.
   2. Outdoor Applications: Stainless steel.
   3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Hilti
      ITW Ramset/Red Head
      B-line

2.11 PIPE STANDS

A. General Requirements for Pipe Stands: Shop or field fabricated assemblies made of manufactured corrosion resistant components to support roof mounted piping.

B. Compact Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Single base unit with integral rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
   3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   4. Hardware: Galvanized steel or polycarbonate.
   5. Accessories: Protection pads.

C. Low Profile, Single Base, Single Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
   3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   4. Vertical Members: Two galvanized steel, continuous thread 1/2 inchrods.
   5. Horizontal Member: Adjustable horizontal, galvanized steel pipe support channels.
   6. Pipe Supports: Roller strut clamps, clevis hanger, or swivel hanger.
   7. Hardware: Galvanized steel.
   8. Accessories: Protection pads.
   9. Height: 12 inchesabove roof, or as indicated on the drawings.

D. High Profile, Multiple Pipe Stand
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

      Miro Industries
      PHP Systems/Design
      Rooftop Support Systems
   2. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   3. Bases: Two or more vulcanized rubber molded polypropylene insert material.
   4. Vertical Members: Two or more galvanized steel channels.
   5. Horizontal Members: One or more adjustable height, galvanized steel pipe supports.
   6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
   7. Hardware: Galvanized steel.
   8. Accessories: Protection pads**,** 1/2 inchcontinuous thread rod.
   9. Height: 24 inchesabove the roof or as indicated on the drawings.

E. Curb Mounted Type Pipe Stands: Shop or field fabricated pipe supports made from structural steel shapes, continuous thread rods, and rollers, for mounting on permanent stationary roof curb.

2.12 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment supports made from structural carbon steel shapes.

2.13 OUTDOOR EQUIPMENT STANDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

Miro Industries
Rooftop Support Systems

B. Description

1. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof supported outdoor equipment components, without roof membrane penetration, in a pre-fabricated system that can be modularly assembled on site.
2. Foot Material: Rubber or polypropylene.
3. Rails Material: Hot dip galvanized carbon steel.
4. Wind/Sliding Load Resistance: Up to 120 mph, or as indicated on the structural drawings.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with all requirements in other section of the specifications for firestopping materials and installation for penetrations through fire rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M, carbon steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation

1. Install powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inchesthick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.
2. Install mechanical expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation
   1. Pipe Stand Types Except Curb Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate the roof membrane.
   2. Curb Mounted Type Pipe Stands: Assemble components or fabricate pipe stands and mounts on a permanent, stationary roof curb.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2” pipe size and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation. Optional: Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees. Optional: Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipes 4”and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. 1/2” to 3-1/2” pipe: 12 incheslong and 0.048 inchthick.
      b. 4” and 5” pipe: 18 incheslong and 0.06 inchthick.
      c. 8” thru 14” pipe: 24 incheslong and 0.075 inchthick.
      d. 16” thru 24” pipe: 24 incheslong and 0.105 inchthick.
   5. Pipes 8”and Larger: Include wood or reinforced calcium silicate insulation inserts of length at least as long as the protective shield.
   6. Thermal Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT HANGERS/SUPPORTS

A. Fabricate structural steel supports to suspend equipment from structure overhead or structural steel stands to support equipment above the floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing for equipment supports to prevent swaying.

3.4 DUCTWORK HANGERS/SUPPORTS

A. Fabricate structural steel supports to suspend ductwork from structure overhead.

B. Fabricate structural steel stands to support ductwork above the floor (when indicated on the drawings). Provide lateral bracing for ductwork supports to prevent swaying.

3.5 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.6 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous thread hanger and support rods to 1-1/2 inches.

3.7 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780/A780M.

END OF SECTION

SECTION 23 07 00 - INSULATION FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of mechanical insulation specified in this section include the following:

1. Piping Systems Insulation
   Condensate Drain Piping
   Condensate Piping
   Refrigerant Piping
2. Ductwork Systems Insulation
   Supply Air and Return Air Ducts
   Clothes Dryer Exhaust Ducts
3. Equipment Insulation
   Removable Insulating Jackets
   Roof-Mounted Mechanical Equipment Curbs

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Insulation specialty firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. IECC Compliance: Comply with applicable portions of the International Energy Conservation Code, including, but not limited to Section C403.13.

C. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) recommendations for all work in this section.

D. ASHRAE Standards: Comply with applicable portions of American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommendations for all work in this section.

E. NFPA Standards: Comply with applicable portions of ANSI/NFPA Standard 90A (Standard for the Installation of Air Conditioning and Ventilating Systems) and ANSI/NFPA 90B (Standard for the Installation of Warm Air Heating and Air Conditioning Systems) for all work in this section.

F. NAIMA Standards: Comply with all applicable portions of the North American Insulation Manufacturers Association (NAIMA) standards for all related work in this section.

G. MICA Standards: Comply with all applicable portions of the Midwest Insulation Contractors Association standards for all related work in this section.

H. Install thermal insulation products on equipment in accordance with the manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of insulation. Submit schedule showing manufacturer's product number, k-Value, thickness, density, and furnished accessories for each mechanical system requiring insulation. Include complete description of installation methods with this submittal.

PART 2 - PRODUCTS

2.1 PIPE INSULATION MATERIALS

A. All pipe insulation thicknesses and conductivities shall meet or exceed the requirements listed in International Energy Conservation Code Section C403.13. All conductivity values listed in this specification section are in Btu-in/(hr-ft^2-°F).

B. Flame/Smoke Spread Ratings: Insulation installed inside the building shall consist of composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with a flame spread rating of 25 or less and a smoke developed index of 50 or less, per ASTM E84.

C. Kitchens, Hospitals, and Pharmacies: All insulated piping exposed in kitchen, hospital, and/or pharmacy areas shall be covered with Type 304 stainless steel jacketing secured with 3/4" wide stainless steel bands at 12" on center.

D. Aluminum Jacketing shall be Johns Manville 'JM Aluminum Jacketing' with 'Polyfilm Moisture Barrier' and stucco-embossed finish, or approved equal, and shall be installed in conformance with the manufacturer's written instructions. Secure jacketing with 3/4" wide Type 304 stainless steel bands at 12" on center. Finish all cold fittings as required to provide a vapor-tight seal. Aluminum and/or stainless steel jacketing shall be provided in the following thicknesses:

1. For Insulation Outside Diameters under 8": .016 inch thick jacketing
2. For Insulation Outside Diameters 8" thru 24": .024 inch thick jacketing

E. Lower Level Exposed in all piping applications shall mean any exposed pipe in a mechanical room, mezzanine area, or other accessible space that is less than 8'-0" above finished floor.

F. Higher Level Exposed in all piping applications shall mean any exposed pipe in a mechanical room, mezzanine area, or other accessible space that is 8'-0" or more above finished floor.

G. Fiberglass Insulation (Concealed Applications)

1. Fiberglass insulation shall be Johns Manville Microlok HP, or approved equal, with factory-applied fire-retardant ASJ jacket, self-sealing laps, and shall be applied per manufacturer's written recommendations. Conductivity shall be 0.23 at 75°F, 0.25 at 125°F, and 0.28 at 200°F. Insulation shall be rated for applications from 0°F up to 850°F. Insulation flame spread/smoke developed rating shall be 25/50 or less in accordance with ASTM E84.
2. Insulate and cover all fittings with Johns Manville Zeston Series 2000 standard gauge pre-molded fitting covers secured with serrated tacks, adhesive, and/or Zeston Z-Tape.
3. Install a segment of rigid calcium silicate insulation at each pipe hanger for pipe sizes 2-1/2 inches and larger.
4. Finish all cold fittings with Zeston Z-tape to provide a vapor-tight seal.
5. Seal all raw ends and exposed fiberglass insulation with Childers CP-10 weather barrier sealant, or approved equal.
6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Johns Manville
   Knauf
   Owens Corning

H. Fiberglass Insulation (Lower Level Exposed Applications)

1. Fiberglass insulation shall be Johns Manville Microlok HP, or approved equal, with factory-applied fire-retardant ASJ jacket, self-sealing laps, and shall be applied per manufacturer's written recommendations. Conductivity shall be 0.23 at 75°F, 0.25 at 125°F, and 0.28 at 200°F. Insulation shall be rated for applications from 0°F up to 850°F. Insulation flame spread and smoke developed rating shall be 25/50 or less in accordance with ASTM E84. Lower level exposed piping shall be covered with aluminum jacketing.
2. Insulate and cover all fittings with aluminum jacketing and aluminum fitting covers.

3. Install a segment of rigid calcium silicate insulation at each pipe hanger for pipe sizes 2-1/2 inches and larger.
4. Finish all cold fittings with Zeston Z-tape to provide a vapor-tight seal.
5. Seal all raw ends of insulation with Childers CP-10 weather barrier sealant, or equal.
6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Johns Manville
   Knauf
   Owens Corning

I. Fiberglass Insulation (Higher Level Exposed Applications)

1. Fiberglass insulation shall be Johns Manville Microlok HP Ultra with performance characteristics as specified for Johns Manville Microlok HP insulation plus a factory-applied polypropylene coating that is cleanable/washable.
2. Insulate and cover all fittings with Johns Manville Zeston Series 2000 standard gauge pre-molded fitting covers secured with serrated tacks, adhesive, and/or Zeston Z-Tape.
3. Install a segment of rigid calcium silicate insulation at each pipe hanger for pipe sizes 2-1/2 inches and larger.
4. Finish all cold fittings with Zeston Z-tape to provide a vapor-tight seal.
5. Seal all raw ends of insulation with Childers CP-10 weather barrier sealant, or equal.
6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Johns Manville
   Knauf
   Owens Corning

2.2 CONDENSATE DRAIN PIPING (INDOORS)

A. Insulate condensate drain piping installed inside the building with fiberglass Insulation. Insulation is not required on condensate overflow drain piping.
   1. Minimum Insulation Thickness for all pipe sizes: 1/2 inch

2.3 REFRIGERANT PIPING INSULATION (INDOORS)

A. Insulate refrigerant suction piping installed indoors with 3/4 inch thick AP Armaflex closed cell foam pipe insulation. Flame spread and smoke developed rating shall be 25/50 or less in accordance with ASTM E84. Fittings and valves shall be covered with segmented sections of the pipe insulation installed in accordance with the insulation manufacturer's instructions. All joints between sections of insulation shall be sealed with Armaflex No. 520 adhesive.

B. Insulate both liquid and suction lines on mini-split system heat pumps and variable refrigerant systems that incorporate heat recovery using the aforementioned insulating materials.

2.4 REFRIGERANT PIPING INSULATION (OUTDOORS)

A. Insulate refrigerant piping installed outdoors with 1 inch thick Johns Manville Trymer 25-50 with vapor retarder film, covered with Polyguard ‘Alumaguard’ all-weather flexible weatherproofing jacketing. Note that Trymer 25-50 closed cell polyisocyanurate insulation is required on outdoor refrigerant piping because it does not expand and contract during weather extremes like AP Armaflex closed cell foam pipe insulation.

B. Insulate both liquid and suction lines on mini-split system heat pumps and variable refrigerant systems that incorporate heat recovery using the aforementioned insulating materials.

2.5 DUCTWORK INSULATION MATERIALS

A. All duct insulation thicknesses and conductivities shall meet or exceed the requirements listed in International Energy Conservation Code Section C403.13. All conductivity values listed in this specification section are in Btu-in/(hr-ft^2-°F).

B. See Specification Section 233100 (HVAC Ductwork) for additional related requirements.

C. Ductwork Insulation (General)

1. All concealed supply air ductwork (rectangular and round) shall be externally insulated unless indicated otherwise on the drawings.
2. All concealed return air ductwork (rectangular and round) that is located in a return air plenum is not required to be insulated, unless indicated otherwise on the drawings.
3. Supply air and return air ductwork that is exposed in a conditioned space does not require insulation.

D. Ductwork Liner Insulation (See Specification Section 233100 (HVAC Ductwork).

E. External Duct Wrap Insulation

1. Unless indicated otherwise, wrap all concealed supply air and return air ductwork with 2-1/5 inch thick, 0.75 pcf density, fiberglass duct insulation with reinforced foil facing (Johns Manville Microlite FSK Type 75, or equal, with an R-value equal to 6.0).
2. Any exposed supply air or return air ductwork that is indicated on the drawings to be insulated shall be insulated with Johns Manville PSK white or black insulation, or approved equal, with matching PSK seaming tape.
3. In addition to the insulation manufacturer's tape flap, all insulation seams shall be sealed with pressure-sensitive tape (Shurtape AF-984CT, or equal). Longitudinal seams shall have a 4 inch overlap of the foil facing secured with outward clinching staples and pressure sensitive tape.
4. Secure insulation on the underside of ducts that are 24 inches wide and above with either weld pins or with Duro-Dyne PBH Dynastick Fasteners adhered with Duro-Dyne PBACZVOC Dynastick Adhesive. Weld pins or fasteners shall be placed on 18" centers and within 6 inches of insulation seams. Any penetrations from pins in the insulation shall be sealed with pressure-sensitive tape.
5. In addition to the aforementioned fastening and seam sealing procedures, all external duct wrap insulation shall be secured with 16 gauge galvanized wire tied on 16" centers and within 8 inches of insulation seams.

2.6 EQUIPMENT INSULATION MATERIALS

A. General: All equipment insulation R-Values and thicknesses shall meet or exceed the requirements listed in 2024 International Energy Conservation Code Section C403.13.

B. New Roof-Mounted Mechanical Equipment Curbs: The Contractor shall install insulation on the interior perimeter of mechanical equipment curbs as indicated or detailed on the drawings and as indicated herein. Insulation shall be two layers of 2 inch thick, rigid closed cell polyisocyanurate insulation, R-Max Thermasheath, or approved equal. Insulating value shall be R-13.1. Secure and/or adhere the insulation in accordance with the insulation manufacturer's written instructions (typically with adhesive and washers with pins or screws).

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING INSULATION

A. The term 'piping' used herein shall include pipe, valves, strainers, and fittings. Apply insulating cements to fittings, valves, and strainers, and trowel smooth to the thickness of adjacent covering. Covering on valves shall extend up to the bonnet. The covering cement shall be of the types specified herein.

B. Install all insulation products in accordance with the manufacturer's written instructions and in accordance with recognized industry practices.

C. Install insulation on pipe systems subsequent to installation of heat testing, and acceptance of tests.

D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full length units of insulation, with single-cut pieces to complete each run. Do not use cut pieces or scraps abutting each other.

E. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

F. Extend piping insulation without interruption through walls, floors, and similar penetrations, except piping through fire walls.

G. Install pipe hangers on the outside of the insulation and not in contact with the pipe. Protect insulation as specified in Specification Section 230500 (Basic Materials and Methods for HVAC Systems) under ‘Hangers and Supports for Ductwork and Piping’.

H. Install a 6 inch long section of rigid insulation at each pipe saddle and/or hanger. Rigid sections shall be calcium silicate.

I. Seal all raw ends of insulation with Childers CP-10 weather barrier sealant, or approved equal.

3.2 INSTALLATION OF DUCTWORK INSULATION

A. Install insulation products in accordance with the manufacturer's written instructions and in accordance with these specifications.

B. Extend ductwork insulation without interruption through walls, floors, and similar penetrations, except ductwork through fire rated walls and where otherwise indicated.

C. Except where otherwise indicated, external duct insulation may be omitted on ductwork where internal duct liner insulation has been specified.

D. Except where otherwise indicated, ductwork exposed in conditioned spaces is not required to be insulated.

3.3 INSTALLATION OF EQUIPMENT INSULATION

A. Install all equipment insulation materials with smooth and even surfaces and on clean and dry surfaces. Replace any poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

B. Do not apply insulation to equipment, flues, breechings, or stacks while hot.

C. Do not insulate cleanouts, ASME stamps, or equipment manufacturer's nameplates. Provide neatly beveled edges at interruptions of insulation.

3.4 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective insulation. Leave entire work in condition satisfactory to the Architect/Engineer. At completion, carefully clean equipment installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.5 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 08 00 - TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

B. Section 230910 (Sequence of Operation) is hereby made a part of this section.

1.2 WORK INCLUDED

A. Temperature performance testing on all heat transfer equipment and/or components.

B. Test and balance of air distribution systems and associated equipment and apparatus.

C. Test and balance of hydronic distribution systems and associated equipment and apparatus.

D. Testing, setting, and adjusting speed and volume of systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by the contract documents.

E. Component types of testing, adjusting, and balancing specified in this section includes the following as applied to mechanical equipment:
Fans
Ductwork Systems
Terminal Units
Air Distribution

1.3 QUALITY ASSURANCE

A. Balance Agency: Provide services and facilities of an independent agency that specializes in testing, analysis, and balancing of hydronic systems and air distribution for heating and/or cooling systems. Work shall be done by qualified engineering technicians and trained personnel, using instruments certified accurate to limits used in standard practice for testing and balancing of hydronic and air distribution for heating and cooling systems. The balance agency shall field test air and hydronic flows in accordance with the methods prescribed by the Associated Air Balance Council, National Standard Volume 1, latest edition.

B. The balance agency shall be a member of the Associated Air Balance Council. Subject to compliance with requirements, the balance agency shall be one of the following (no exceptions):

RS Analysis
Raglen System Balance

C. The balance agency shall submit the results of tests in this section to the Architect/Engineer for review and acceptance.

D. AABC Compliance: Comply with AABC ‘National Standards’ Volume 1, as applicable to mechanical air and hydronic distribution systems and associated equipment and apparatus.

E. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting and balancing, except as otherwise indicated.

F. Reference Standards

1. AABC (Associated Air Balance Council) AABC National Standards Volume 1.
2. ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers).

G. Test Instruments: Utilize test instruments and equipment for the test and balance work required, of type, precision, and capacity as recommended in AABC National Standards Volume 1.

1.4 SUBMITTALS

A. Provide a test and balance agenda that includes step-by-step testing and balancing procedures, test sheets, and schematic drawings, all being specific to the project.

B. Provide submittals to indicate the extent of work proposed. Submit certified test reports as hereinafter specified signed by test and balance technician/supervisor that performed test and balance work.

C. Include identification and types of instruments used and their most recent calibration date with submission of final test report.

D. The completed balance report shall be submitted for review and approval prior to requesting final observation of the project.

1.5 GENERAL REQUIREMENTS

A. The balance agency shall perform the following during the installation phase of systems:

1. Study the design drawings and specifications and prepare a schedule to physically inspect mechanical equipment for the hydronic and air distribution systems to be tested and balanced. The Contractor shall provide the balance agency with one copy of the contract drawings and specifications, mechanical equipment submittals, and change orders as necessary for proper balancing of the hydronic and air distribution systems.
2. The test and balance agency shall make field inspections prior to closing in portions of systems to be balanced. The balance agency shall verify that all work, fittings, dampers, balancing devices, etc. are properly fabricated and installed as shown or specified and that the balance agency will be able to properly balance the systems. Any problems or deficiencies shall be reported in writing to the Contractor, Mechanical Engineer, and CxA as soon as possible.
3. Prepare a testing and balancing schedule, test record forms, and necessary technical information regarding hydronic and air distribution systems for the installed heating and cooling equipment.
4. Provide written documentation when the above noted items have been completed, (see example checklist provided at the end of this section). A single page letter signed off by the mechanical contractor and the test and balance agency will suffice.
5. Recommend adjustments and/or corrections to mechanical equipment and hydronic and air distribution systems that are necessary for proper balancing of systems. Provide written documentation of the recommended items to the Architect/Engineer for review.

B. Patching Materials: Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork, and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes. At tester's option, plastic plugs with retainers may be used to patch drilled holes in low pressure ductwork and housings (2” w.g. and below).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TESTING AND BALANCING

A. Upon completion of hydronic and air handling systems, the test and balance agency shall complete tests, analysis, and balance of hydronic and air handling systems for all heating and cooling equipment.

B. The report shall include as minimum, design and actual information for the following:

1. All mechanical equipment scheduled on the drawings.

2. Motors, pumps, and fans: Horsepower, brake horsepower, revolutions per minute, actual amperage, full load rated amperage, pump flow and head data, etc.
3. Supply, return, and exhaust fans: CFM, static pressure, and outlet velocity.
4. Terminal units: CFM, reheat coil pressure drop and air temperatures at inlet and outlet.
5. Inlets, outlets, and main branch ducts: CFM and air velocity.
6. All rooms: Air temperature during testing.
7. Other information as required to establish completely balanced systems under design conditions.

3.2 BALANCING REQUIREMENTS AND TOLERANCES

A. All water systems, coils, and balancing valves shall be balanced to within 0 to +5% of design.

B. All air systems and air distribution devices (supply, return, and exhaust) shall be balanced to within 0 to +10% of design. This requirement applies to all main supply, return, and exhaust air ducts, as well as all air distribution devices.

C. On all air handling systems scheduled for 3,500 cfm or greater, make allowance for air filter resistance at the time of testing, by false-loading the filter bank with cardboard or other suitable material such that the test results can be repeated during the commissioning process.

D. When applicable, maintaining the designed space pressure relationships shall have priority over the tolerances specified above.

E. After final air and hydronic testing and balancing make necessary adjustments to obtain uniform temperatures during actual occupancy.

F. Take static pressure and air velocity readings with instruments that have been recently calibrated. Take final velocity readings with an Alnor velometer, Anemostat air meter, or vane type anemometer, all recently calibrated prior to testing. Include certified correction curves for each calibration as part of the record. Certify instruments are accurate to standards currently used in common practice for system balance work. Use test cones for diffusers.

G. Run tests with supply, return, and exhaust systems operating and doors, windows, etc. closed or under normal traffic. Conduct final testing with cooling coils under load to ensure that static pressures are or near design conditions.

H. Adjust deflection of supply outlets to ensure proper and uniform air distribution.

I. Work with the temperature control subcontractor in adjustment of automatic dampers, valves, thermostats, etc. as required to maintain proper temperatures in all portions of the building.

J. The Contractor responsible for installing heating, cooling, and ventilating equipment shall make any changes, additions, or modifications to dampers, fan drives, motor sheaves, pump impellers, motors, and other equipment as necessary for proper air and hydronic balance.

K. Balance of systems shall be reviewed by the Architect/Engineer. During this review the mechanical contractor shall furnish workmen, materials, ladders, etc. to enable the Architect/Engineer to witness all readings as may be directed. If any errors are found, the Testing and Balancing Agency shall readjust the system to the satisfaction of the Architect/Engineer.

L. The test and balance agency shall complete a Field Observation Report upon completion of the testing and balancing. See the following Field Observation Checklist Example.

3.3 PRE-SEASON STARTUP

A. Within one year of filing of the Notice of Substantial Completion, when all full load tests required under 'Project Completion Tests and Startup' and 'Post Contract Completion Tests' have not yet been performed, the Contractor shall perform startup of any equipment or systems required for heating or cooling season operation when such equipment and systems have remained shut down or remain to be tested under full load. The Contractor shall ensure that all equipment and systems are operating properly before being turned over for the first operational use by the Owner. All such testing shall occur within one year of filing the Notice of Substantial Completion. The Owner will be responsible for providing new air filters for the Contractor to install prior to this testing if necessary.

Field Observation Checklist (Example)			
YES	**NO**	**N/A**	
□	□	□	Is all ductwork intact?
□	□	□	Are all access doors installed and secured tightly?
□	□	□	Are any air distribution inlets or outlets missing?
□	□	□	Are all turning vanes installed correctly?
□	□	□	Is the ductwork, fan inlets and outlets, installed according to the plans and specifications?
□	□	□	Are all balancing dampers, including fire-smoke dampers, installed and accessible?
□	□	□	Are all terminal boxes, reheat coils, and reheat components installed and accessible?
□	□	□	Does the return air have an unobstructed path from each conditioned space back to the unit?
□	□	□	Is the building architecturally complete?
□	□	□	Are all doors, windows, ceilings, and partitions installed?
□	□	□	Are all filters installed correctly and have frames that will not allow leakage?
□	□	□	Are all coils clean and properly installed?
□	□	□	Are the automatic control dampers installed in the correct locations?
□	□	□	Are the fan housings & plenums sealed & installed according to the plans and specifications?
□	□	□	Are all flexible duct connections installed properly without kinks?
□	□	□	Are suitable duct traverse locations available wherever necessary?
□	□	□	Is all piping intact and free of leaks?
□	□	□	Are all pumps, piping, and equipment installed according to the plans and specifications?
□	□	□	Are all valves, flow meters, and temperature-pressure taps installed to allow for TAB?
□	□	□	Are all valves, flow meters, and temperature-pressure taps accessible?
□	□	□	Are all valves piped correctly?
□	□	□	Are all terminal unit coils installed and piped correctly, and accessible?
□	□	□	Have all piping systems been cleaned, flushed, and treated?
□	□	□	Are all air vents properly installed?
□	□	□	Are vibration isolators properly installed and adjusted?
□	□	□	Are all flexible coil connections installed properly?

Notes: This checklist is an example and shall be customized for each individual project.
N/A = Not Applicable to this project.

END OF SECTION

SECTION 23 09 00 - TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

B. Section 230910 (Sequence of Operation) is hereby made a part of this section.

PART 2 - SCOPE OF WORK

2.1 GENERAL

A. The control system shall provide direct digital control with a Windows-based user interface. Third party viewing software is not acceptable. The manufacturer and/or his authorized representative shall be responsible for all work under this section of the specifications. Only pre-approved manufacturers and contractors will be allowed and shall be as follows (no substitutions):

Manufacturers	Northern Nevada Contractors	Telephone
Alerton Controls	Cerris Systems (formerly BCS Controls)	(775) 826-8998

B. Furnish and install an energy management control system (EMCS) and direct digital control (DDC) system complete with computer terminal (when specified), modem, surge suppressor, operating software, and training. Install the temperature control system software (most current edition) on the existing computer at the using agency's office and on the computer at the project site (when an on-site computer is specified). When third party software is necessary to allow for control system programming and/or editing of graphic displays that software (most current edition) shall also be provided on each of the aforementioned computers.

C. There shall be no annual maintenance or licensing fees of any kind required to be paid by the Owner at any time during the ongoing use of the installed system and software. Licenses shall be issued and authorized as directed by the Owner. Licenses shall be issued such that they can be modified by the Owner without the permission of the contractor and/or local system integrator. Specific license wording and format shall be provided as part of the contractor's submittals.

D. On any project that involves removal of existing controls, the Owner shall be given an opportunity to identify any control devices that they would like to have turned over to them for potential future use.

E. The temperature control contractor shall assist the testing and balancing contractor with temporary adjustments of control system programming and setpoints as necessary for proper completion of the testing and balancing scope of work.

F. Alerton Controls System

1. The Alerton Controls System shall be configured with multiple Ethernet connections to allow for remote network access and for direct connection of multiple computers via local area network. The Alerton Controls system shall utilize 'Compass' web-based graphic interface software (most current version). Communication with equipment controllers shall be via BACnet IP Ethernet backbone at 100.0 Mbps minimum speed. Controllers for central plant equipment and/or air handling units shall be Alerton ACM series with AXM expansion I/O modules or Alerton VIP series equipment controllers. All equipment controllers shall be furnished with integral hand-off-auto switches. Communication between equipment controllers and application specific controllers (Alerton VLC series) shall be via BACnet MS/TP network at 76.8k minimum speed.

2.2 SPARE CONTROLLER CAPACITY

A. All controllers for central plant equipment and air handling units (except application-specific controllers for unitary equipment) shall be furnished with a minimum of 10 percent spare capacity to allow for addition of both analog and digital inputs and outputs.

2.3 SUBMITTALS

A. The written control sequences, initial setpoints, dead-bands, and the graphic displays shall all be reviewed and confirmed with the Owner and the Engineer prior to preparing and forwarding the finalized submittals.

B. The submittals shall include complete written control sequences for each item of equipment requiring control. The sequences shall include all setpoints, dead-bands, etc. required for successful operation of the specified equipment. The submitted sequences shall include all necessary sequencing details, whether or not those details are furnished as part of the mechanical engineer's written control sequences (such details are commonly excluded from the Engineer's written control sequences) and all work associated with developing and incorporating those details shall be provided by the Temperature Controls Contractor at no additional cost to the Owner.

C. The Temperature Control Contractor shall prepare and submit a complete listing of BACnet points that are to be set up as trended and stored historical data. The list shall be broken down to include each system and/or item of equipment and shall be reviewed with the Owner and the Engineer for approval prior to setting up the trending in the temperature control system. The BACnet trend log names shall also be provided for approval.

2.4 AS-BUILT DOCUMENTATION

A. After all temperature control sequences have been finalized and have been approved by the Owner and the Engineer, and after the HVAC systems commissioning process has been completed, the Contractor shall provide as-built documentation which shall include both an electronic copy and a hard copy of the finalized as-built documentation and programming.

B. The as-built documentation shall include the following as a minimum:
   1. Include the final sequence of operation, including any adjustments that were made during commissioning.
   2. Include finalized programming flow charts or line code as applicable.
   3. Depict accurate wiring 'pathways' on a separate wiring floor plan.
      a. The sequential order of how the equipment is wired in the daisy-chained wiring floor plan shall match the sequential order of how the equipment is laid out in the overall network diagram.
      b. The wiring floor plan shall include delineation indicating the type of communication wiring used.
      c. The final location of all room temperature sensors shall be depicted on the wiring floor plan.
      d. The final location of all occupancy sensors shall be depicted on the wiring floor plan (when applicable).
      e. Provide a legend on the wiring floor plan indicating both the controller addresses and the equipment tag numbers.
   4. The equipment flow diagrams shall include accurate equipment configurations, and all installed control componentry (actuators, sensors, etc.).
   5. The equipment flow diagrams shall include the input and output numbers (for example, AO1 = Analog Output 1, BO2 = Binary Output 2, BI3 = Binary Input 3) which shall accurately match the tagging and numbers shown in the associated controller diagrams.

2.5 TRAINING

A. Upon completion of the commissioning process, the Temperature Controls Contractor shall instruct the Owner's designated personnel on the operation of all control system software features, shall provide a complete explanation of the control sequence for each item of equipment, and shall provide instructions on the operation and maintenance of all control devices. Training time shall be a minimum of 8 total hours (consisting of 2 separate 4 hour sessions).

2.6 WARRANTY PERIOD SERVICES

A. The Contractor shall provide full service for the temperature control system for a period of one year after the date of substantial completion. Service shall include, as a minimum, calibration of all sensors and other control devices, adjustments to setpoints, and modifications to control sequences and/or programming as required or requested to fine-tune and/or finalize all control sequences.

B. The Contractor shall provide a scheduled monitoring and reporting service for the duration of the one year warranty period. Monitoring shall be conducted via the remote control system interface (via modem or network connection) and the associated report shall be issued via email the same day that the monitoring is conducted. Monitoring shall be conducted on a weekly basis, preferably on either Monday or Tuesday. Reports shall include a specific listing of all alarms, all equipment failures, any noted operational problems or irregularities, and a set of screen prints. The weekly reports shall be emailed to the Owner and the Engineer.

2.7 SOFTWARE AND PROGRAMMING REQUIREMENTS

A. Provide a security/password system with two passwords (username and password). The security/password system shall allow access based on user security level as follows:

Level 1 Viewing only
Level 2 Room temperature and occupancy schedule adjustment
Level 3 Adjustment of all setpoints
Level 4 Full access to all setpoints and programming

B. The Temperature Controls Contractor shall program the applicable holidays into the EMCS software for the five years following the date of the installation.

C. Equipment Schedules: Schedules shall be coordinated with the Owner. A separate or combined occupied/unoccupied schedule shall be provided for each air handling unit, fan coil unit, exhaust fan, and/or other individual air handling system as designated by the Owner.

2.8 GRAPHIC DISPLAYS

A. All temperature setpoints and all other setpoints identified as adjustable in the written control sequence shall be adjustable from the appropriate graphic display(s). Setpoints listed in the contract documents are for initial set-up and trial of system operations. Control system shop drawings shall utilize the same (or similar) written sequences with all setpoints, throttling ranges, and differentials identified. As-built drawings shall include this same information with final setpoints resulting from startup, testing, and adjustment.

B. Monitored points and alarms for each system shall be shown on the displays with full color graphics and real-time data as listed below. Where indicated, graphic displays shall be dynamic (animated). All graphic displays shall be submitted to the Owner and the Engineer for review and modification as directed.

C. All temperatures shall be displayed with zero decimal places.

D. All valve and damper positions shall be displayed as percent open and shall be displayed with zero decimal places.

E. All setpoints which are identified as ‘adjustable’ in the written control sequences shall be adjustable via the associated graphic displays (including deadband between room setpoints).

F. All occupied mode and unoccupied mode room temperature setpoints shall have an adjustable deadband (adjustable from the associated graphic display).

G. All displays specified to be dynamic shall depict motion (as a minimum, dynamic displays shall include chiller compressors, boiler burners, rotating fan wheels, and rotating pump impellers).

H. All setpoints adjustable from the graphic displays shall be programmed with the deadband on one side of the setpoint (not split evenly across the setpoint) unless otherwise specified.

I. All outputs shall be programmed with the capability for the user to override the controlled commands/positions via the associated graphic display (this requirement applies to all equipment, valves, dampers, fans, pumps, etc.).

J. Alarm data fields shall be displayed with a red text when an alarm condition exists.

K. A summary table shall be provided in the graphic screens to display the current status of each fire-smoke damper. The summary data shall also include the approximate location of each fire-smoke damper.

L. A set of zone temperature summary screens shall indicate the current room temperature setpoint and current room temperature for each zone. A separate global setpoint and deadband shall be assigned to all zones associated with each air handling unit. The zone summary screens shall also include additional information for each zone such as the remote setpoint and deadband, discharge air temperature, valve position, fan command, fan status, deadband setpoint(s), etc. Summary screen format, function, and required display data shall be coordinated with the Owner prior to developing the graphic displays.

M. Each zone shall be capable of being set to any of three setpoints (depending on which setpoint is selected). The three available setpoints shall be the global setpoint (a single setpoint for all associated zones), the remote setpoint (a separate individually adjustable setpoint for each zone), and the local setpoint (adjustable at the room sensor by utilizing a slide or dial type control on the room sensor). The local setpoint adjustment range shall be programmed to allow adjustment only between a fixed temperature range (typically between 73ºF and 75ºF - range to be confirmed with the Owner prior to programming).

N. The current total cfm of all vav boxes associated with each vav air handling unit shall be calculated and displayed on the appropriate air handling unit screen.

O. Each variable frequency drive shall be programmed to display command, status (via current sensor), input speed, output speed, and alarm/failure status (via alarm contacts at each vfd).

P. Floor Plan(s): Provide a display showing the building floor plan(s) with all space temperature sensors including identification of the associated terminal unit or fan coil unit number. Specifically identify each thermal zone on the associated floor plan (AutoCAD file with thermal zone borders can be obtained from the mechanical engineer at no cost to the Contractor).

Q. The current room temperature status shall be indicated utilizing custom thermal geometry outlines around each thermal zone with dynamic color and opacity based on the current zone temperature.

R. The finalized sequence of operation shall be inserted into the graphics for viewing as a pdf file.

2.9 SPECIALTY CONTROL DEVICES AND REQUIREMENTS

A. Outdoor temperature sensor (dry bulb only) shall be Mamac Systems Model TE-213-F with solar radiation and precipitation shield, Dwyer Model TE-RND with solar radiation and precipitation shield, or approved equal.

B. Current sensors for fan and pump motors less than one horsepower shall be split core digital output type and shall have an adjustable setpoint capability.

C. Duct temperature sensor probes shall have a minimum length of 6 inches and shall be selected with longer lengths when required to ensure accurate temperature readings and to avoid dead air spaces.

2.10 MISCELLANEOUS REQUIREMENTS

A. All control devices shall be installed in reasonably accessible locations. Control devices that may require occasional calibration or adjustment shall be given special consideration with regard to being installed in a reasonably accessible location.

B. Room temperature sensors shall be programmable touchscreen type and shall be provided with an override feature and setpoint adjustment with the ability to be limited or locked out via the operator workstation. The type of room sensor shall be confirmed with the Owner and the Engineer prior to issuing the associated submittal and prior to ordering.

C. Room temperature sensors shall be labeled with the corresponding terminal unit or fan coil unit number. Labels shall be self-adhesive with black lettering (1/8” height lettering).

D. Room temperature sensors installed on an exterior wall shall have a full thickness of insulation placed in the junction box behind the sensor.

E. Room temperature sensors in laboratory areas shall be sealed at the wall penetration behind the sensor to prevent air migration into the sensor from adjacent areas (due to the negative pressure of labs as compared to adjoining spaces).

F. Equipment specified to include a BACnet interface shall be provided with a terminal strip to allow remote control of the equipment via the direct digital control system (verify the specifics of this requirement on the equipment schedules and in the equipment specifications).

G. When an air handling unit is depicted as including a temperature sensor at the inlet and at the outlet of the chilled water and/or heating water coil those sensors shall be ‘paired thermistors’.

H. Sensor wells installed in a potable water system shall be stainless steel.

I. All control dampers in stainless steel ductwork shall be constructed of stainless steel and shall have flanged connections.

J. An as-built control diagram shall be laminated and secured inside of each temperature control panel prior to commencement of the final on-site mechanical systems commissioning sessions.

K. Trend logs shall be coordinated with the Owner and shall include as a minimum all temperature, pressure, gpm, cfm, percentage, status, and alarm data that is identified and requested.

L. Communication wiring at global controller(s) shall be physically labeled in the field to accurately reflect the equipment or device that it is connected to, so that the maintenance staff can quickly identify the associated equipment without going to the equipment location or looking at the as-builts.

M. Each piece of equipment shall have its own separate equipment controller, except for a project with terminal units (vav boxes). Grouping of multiple equipment items on a single controller is not acceptable. This is intended to ensure that failure of a single controller does not take down multiple pieces of equipment.

N. All low voltage wiring (whether plenum rated or not) shall be installed in raceways with the following conditions, clarifications, and exceptions.
   1. Raceways shall be as defined in the National Electrical Code and open cable trays shall not be construed as meeting the definition of a raceway.
   2. Low voltage wiring for temperature controls and energy management systems may be routed utilizing open cable trays above accessible ceilings. Low voltage wiring for temperature controls and energy management systems may also be installed utilizing appropriately spaced and neatly routed j-supports above accessible ceilings. Low voltage wiring routed in walls or at roof penetrations shall be installed in conduit.
   3. Where open cable trays are utilized above accessible ceilings the following conditions apply.
      a. Low voltage wiring routed in open cable trays shall be plenum-rated (whether or not the ceiling space is utilized as a return air plenum).
      b. Low voltage wiring concealed in walls, floors, and above inaccessible ceilings shall be routed in raceways.
      c. Low voltage wiring routed between conduit stubs and cable trays shall be secured with appropriately spaced j-supports.

PART 3 - EXECUTION

3.1 PRE-SEASON STARTUP

A. Within one year of filing of the Notice of Substantial Completion, when all full load tests required under ‘Project Completion Tests and Startup’ and ‘Post Contract Completion Tests’ have not yet been performed, the Contractor shall perform startup of any equipment or systems required for heating or cooling season operation when such equipment and systems have remained shut down or remain to be tested under full load. The Contractor shall ensure that all equipment and systems are operating properly before being turned over for the first operational use by the Owner. All such testing shall occur within one year of filing the Notice of Substantial Completion. The Owner will be responsible for providing new air filters for the Contractor to install prior to this testing if necessary.

END OF SECTION

SECTION 23 24 00 - REFRIGERANT PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Refrigerant piping and accessories as indicated on the drawings and as specified herein.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for refrigerant piping systems.

1.4 QUALITY ASSURANCE

A. Flammable refrigerant piping systems shall be installed and tested in strict accordance with ASHRAE Standard 15, including Sections 9.12 (Refrigerant Systems Installation) and 9.13 (Refrigerant Systems Testing).

B. For all flammable refrigerant systems containing 55 lbs or more of refrigerant, the installing contractor shall submit a certificate to the Architect/Engineer and the Owner verifying that the required strength testing and leakage testing has been successfully performed as described in ASHRAE Standard 15 Section 9.13 (Refrigerant Systems Testing).

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING REQUIREMENTS

A. Refrigerant Piping: Type ACR-L hard drawn copper refrigerant tubing with wrought copper solder joint fittings. All joints shall be brazed. Soft drawn copper line sets are not acceptable.

B. Piping Components: The following refrigerant piping components shall be provided.

1. Condensing Unit Service Valves (if not provided integral to the condensing unit by the condensing unit manufacturer (Emerson BV Series, Henry 907 Series, or approved equal).
2. Sight Glass (Emerson HMI Series, Henry MI Series, or approved equal). Sight glasses are not required on mini-split heat pumps and variable refrigerant systems).
3. Filter-Drier (Emerson EK Series, Henry SDM Series, or approved equal). Filter-driers are not required on mini-split heat pumps and variable refrigerant systems).

2.2 REFRIGERANT PIPING INSULATION

A. See Specification Section 230700 (HVAC Insulation).

PART 3 - EXECUTION

3.1 INSTALLATION OF REFRIGERANT PIPING

A. Furnish and install all interconnecting refrigerant piping as shown and/or required. Piping shall be sized in accordance with the equipment manufacturer's recommendations. Pitch suction piping down in the direction of flow.

B. Test all refrigerant piping for leaks with an electronic leak detector.

C. Seal and flash all roof and wall penetrations. Provide metal or plastic pipe shields between insulated refrigerant piping and hangers.

D. Install refrigerant piping and refrigerant-containing components in accordance with ASHRAE Standard 15 and ASME B31.5
   1. Install piping as short as possible, with a minimum number of joints, elbows, and fittings.
   2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 1 inch minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation.
   3. Install condensing unit isolation valves whenever they are not included integral to the condensing unit.
   4. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally, locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing.
   5. Use copper tubing in protective conduit when installed below ground.
   6. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's recommendations.

E. Joint Construction
   1. Brazed Joints: Comply with AWS Brazing Handbook and with filler materials complying with AWS A5.8/A5.8M.
   2. Use Type BcuP copper-phosphorus alloy for joining copper socket fittings with copper tubing.
   3. Use Type BAg cadmium-free silver alloy for joining copper with bronze or steel.
   4. Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.
   5. Pass nitrogen gas through the copper piping to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

F. Protect refrigerant system during construction against entrance of foreign matter, dirt, and moisture; having open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.

G. Pipe refrigerant relief valve discharge to outdoors for systems containing more than 100 lbs of refrigerant.

3.2 REFRIGERANT SYSTEM PRESSURE TESTING, EVACUATION, AND CHARGING

A. Refrigerant system pressure testing, evacuation, and charging procedures shall be performed in the presence of the Owner's representative and/or the Engineer after the refrigerant piping system installation is complete.

B. Prior to evacuation and charging, the refrigerant system shall be pressure tested with nitrogen per the equipment manufacturer’s written recommendations for test pressure(s). Pressure testing shall be conducted when the ambient temperature is relatively stable and shall hold for a minimum of 4 hours without a drop in pressure.

C. Utilize properly sized vacuum pump(s) for refrigerant system evacuation. The refrigerant system compressor shall not be utilized to evacuate the system, nor operated at any time prior to completing the specified triple evacuation procedure. Conduct evacuation and charging procedures at ambient temperatures of 60°F or above whenever practical. If ambient temperatures are consistently below 60°F, contact the Owner and/or the Engineer immediately for approval to proceed or for alternative direction.

D. The first evacuation shall be to 1,000 microns, holding at 1,000 microns for a minimum of two hours. Break the vacuum with either nitrogen or refrigerant.

E. The second evacuation shall be to 750 microns, holding at 750 microns for a minimum of two hours. Break the vacuum with either nitrogen or refrigerant.

F. The third evacuation shall be to 500 microns, holding at 500 microns for a minimum of two hours. Break the vacuum with either nitrogen or refrigerant.

G. After testing, fully charge each system with refrigerant and then conduct a leak test of the entire system with an electronic leak detector.

3.3 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 31 00 - HVAC DUCTWORK

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of ductwork specified in this section include the following:

Sheet Metal Ductwork
Flexible Ductwork
Internally Lined Ductwork
Externally Insulated Ductwork
Clothes Dryer Exhaust Ductwork

1.3 QUALITY ASSURANCE

A. Installer: A firm with at least three years of successful installation experience on projects similar to that required for this work.

B. IECC Compliance: Comply with applicable portions of the International Energy Conservation Code, including, but not limited to Section C403.13.

C. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) recommendations for all work in this section.

D. ASHRAE Standards: Comply with applicable portions of American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommendations for all work in this section.

E. NFPA Standards: Comply with applicable portions of ANSI/NFPA Standard 90A (Standard for the Installation of Air Conditioning and Ventilating Systems) and ANSI/NFPA 90B (Standard for the Installation of Warm Air Heating and Air Conditioning Systems) for all work in this section.

F. NAIMA Standards: Comply with all applicable portions of the North American Insulation Manufacturers Association (NAIMA) standards for all related work in this section.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on manufactured products and factory fabricated ductwork used for the work of this section.

B. As-Built Drawings: At project closeout, submit as-built drawings of installed ductwork, duct accessories, outlets, and inlets.

PART 2 - PRODUCTS

2.1 GENERAL

A. All duct dimensions shown on the drawings are the net clear inside dimensions.

B. All duct insulation thicknesses and conductivities shall meet or exceed the requirements listed in International Energy Conservation Code Section C403.13. All conductivity values listed in this specification section are in Btu-in/(hr-ft^2-°F).

C. Fabricate all ductwork using a commercial grade of galvanized steel complying with the SMACNA HVAC Duct Construction Standards (latest edition) for the specified duct pressure class.

D. Fabricate ductwork with all accessories installed during fabrication to the greatest extent possible. Refer to Specification Section 233110 (HVAC Ductwork Accessories) for accessory requirements.

E. See Specification Section 230700 (Insulation for HVAC Systems) for additional requirements.

F. All ductwork shall be constructed and sealed in accordance with the requirements of the Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) unless indicated otherwise herein.

G. Construct and seal all ductwork in accordance with the pressure related to the equipment or system to which it is connected unless indicated otherwise herein. See Section 3.1 of this specification for additional requirements and clarification.

H. Ductwork upstream of terminal units shall be 4” w.c. pressure class and ductwork downstream of terminal units shall be 2” w.c. pressure class.

I. Wherever ductwork is to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.

J. Wherever ductwork is to be exposed to view in occupied spaces and is indicated to be painted, that ductwork shall be fabricated using a commercial grade of phosphatized, galvannealed, or bonderized sheet metal that is specifically formulated for painting.

K. Duct fittings shall be constructed to match the adjoining ductwork and to comply with all duct requirements applicable to fittings. See ‘Typical Branch Ducts’ details on the drawings for acceptable fitting types.

L. Turning Vanes in Rectangular Duct Elbows: Turning vanes shall be provided in all rectangular duct elbows unless indicated otherwise on the drawings, such as in return air transfer ducts, where turning vanes shall not be installed. All turning vanes shall be SMACNA ‘Large’ (R=4.5”/SP=3.25”). Turning vanes in medium pressure ducts (3.0“ w.c. or greater) shall be double thickness. Turning vanes in low pressure ducts (2.0“ w.c. or less) with duct widths 30 inches and smaller shall be single thickness. Turning vanes in low pressure ducts (2.0“ w.c. or less) with duct widths 32 inches and larger shall be double thickness.

M. Except as otherwise indicated, or where a reaction between dissimilar metals might occur, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim, and angles for support of all ductwork. Utilize Unistrut channel supports and hangers as appropriate for larger duct sizes. Penetrating ductwork with screws shall be avoided to the greatest extent possible. Wherever screws are required to penetrate ductwork the penetrations shall be sealed air and water tight.

2.2 TWO INCH PRESSURE CLASS DUCTWORK

A. Rectangular ductwork shall be fabricated using a commercial grade of galvanized steel complying with the SMACNA HVAC Duct Construction Standards (latest edition) for the specified duct pressure class. Ductwork and fitting gauges shall be in accordance with Chapter 2 of the SMACNA HVAC Duct Construction Standards (latest edition).

B. Round ductwork shall be spiral lock seam round and/or oval duct and fittings.

2.3 ROUND AND OVAL DUCTWORK

A. Round and Oval Ductwork: Provide spiral lock seam pre-fabricated duct, constructed and sealed for 4 inch pressure class. The requirement for spiral lock seam round and oval ducts also applies to 2 inch pressure class round and oval ductwork. Longitudinal seam round or oval ductwork is not acceptable.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory fabricated ductwork which may be incorporated in the work include the following, or approved equal:

Manufacturer
McGill Airflow Uni-Seal
Semco
OmniDuct
Air Handling Systems

C. Spiral lock seam prefabricated factory-built round and oval duct and fittings shall be used wherever possible. Shop fabricated ducts shall be used only where rectangular shaped ducts are shown on the drawings or where transitions and special fittings cannot be prefabricated by the factory.

D. Optional Shop Fabricated Ductwork and Fittings: As an alternative to factory fabricated ductwork, the Contractor may shop fabricate the spiral seam ductwork provided that certification is submitted and approved indicating that the shop fabricated ductwork and fittings are equal to that specified for factory fabricated ductwork and fittings.

E. Shop fabricate ductwork in 4, 8, 10, or 12 foot lengths, unless otherwise indicated or required, to complete duct runs. Pre-assemble ductwork in the shop to the greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to the extent necessary for shipping and handling. Match and mark duct sections for reassembly and for a coordinated installation.

F. Round and Oval Fittings: The following round duct fittings shall be used, in accordance with what is depicted on the drawings.

1. All round fittings shall be full bodied type.
2. Round elbows shall be constructed with a 1.5 radius to diameter (R/D) ratio.
3. Round elbows shall be segmented/gored type, constructed in accordance with the current SMACNA Duct Construction Standards. Adjustable elbows are not acceptable.
4. Low loss conical tees, conical laterals, reducing tees, and 90° crosses.
5. Reducers and increasers shall be constructed for a maximum angle of 30 degrees.
6. Spin-in and/or tap-type fittings that require field cuts into the ductwork are not acceptable.
7. No exceptions will be allowed to the listed fitting requirements.

G. Concealed Round and Oval Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A653, in conformance with the listed manufacturing method, and in the listed minimum duct and fitting gauge.

Diameter	Minimum Duct Gauge	Minimum Fitting Gauge	Manufacturing Method
3" to 14"	28	28	Spiral Lockseam
16" to 24"	26	26	Spiral Lockseam
26" to 42"	24	24	Spiral Lockseam
44" to 60"	22	22	Spiral Lockseam
62" to 96"	20	20	Spiral Lockseam

H. Exposed Round and Oval Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A653, in conformance with the listed manufacturing method, and in the listed minimum gauge. Note that exposed round and oval ductwork is required to be heavier gauge than concealed round ductwork so that potential damage or denting is less likely.

Diameter	Minimum Duct Gauge	Minimum Fitting Gauge	Manufacturing Method
3" to 14"	26	26	Spiral Lockseam
16" to 24"	24	24	Spiral Lockseam
26" to 42"	22	22	Spiral Lockseam
44" to 60"	20	20	Spiral Lockseam
62" to 96"	18	18	Spiral Lockseam

I. Identification of Round and Oval Ductwork and Fittings: To allow for field verification of the appropriate gauge material, round duct and fitting factory labels shall be visible from the floor such that they can be observed prior to insulating.

2.4 HANGERS AND SUPPORTS FOR DUCTWORK

A. See Section 230530 (Hangers and Supports for HVAC Systems)

2.5 SEISMIC BRACING FOR DUCTWORK

A. See Section 230540 (Seismic Bracing for HVAC Systems)

2.6 DUCT ACCESS DOORS

A. See Specification Section 233110 (HVAC Ductwork Accessories).

2.7 DUCTWORK INSULATION

A. All 4 inch pressure class rectangular and round supply, return, and outside air ductwork shall be externally insulated unless specifically indicated otherwise in these specifications or on the drawings. See Specification Section 230700 (Insulation for HVAC Systems) for associated requirements.

B. All 2 inch pressure class rectangular and round supply, return, and outside air ductwork shall be externally insulated unless specifically indicated otherwise in these specifications or on the drawings. See Specification Section 230700 (Insulation for HVAC Systems) for associated requirements.

C. Internal Duct Liner Insulation

1. Internal duct liner at transfer ducts shall be 1” thick Johns Manville Linacoustic R-300 Duct Liner, or approved equal, with an insulating value of R-6.3 and a 25/50 flame and smoke spread rating in accordance with ASTM E84.
2. Internal duct liner indicated elsewhere on the drawings shall be 1-1/2” thick Johns Manville Linacoustic R-300 Duct Liner, or approved equal, with an insulating value of R-6.3 and a 25/50 flame and smoke spread rating in accordance with ASTM E84.
3. Cut and adhere internal duct liner, and seal all fiberglass edges in strict accordance with the duct liner manufacturer’s written application instructions.
4. Additionally secure duct liner with weld pins or with Duro-Dyne PBH Dynastick Fasteners adhered with Duro-Dyne PBACZVOC Dynastick Adhesive. Fastener spacing shall be in accordance with the insulation manufacturer’s written instructions.
5. Adjust all duct sizes shown on the drawings to accommodate the liner thickness, and provide the net internal duct dimensions shown on the drawings.
6. For internal duct liner at terminal units (vav boxes) see Specification Section 23 36 00 Terminal Units (VAV Boxes).

2.8 MISCELLANEOUS DUCTWORK MATERIALS

A. Provide miscellaneous materials and products of types and sizes indicated, unless otherwise indicated. Provide per the requirements listed in the latest SMACNA manuals, including proper connection of ductwork and equipment.

B. Duct Joints: Join and seal prefabricated, factory built ducts, fittings, and couplings in strict accordance with duct manufacturer's instructions. Install duct sealers, pop rivets, or sheet metal screws, canvas, and lagging adhesive on each joint. Duct sealer shall be fire retardant. Sheet metal screws for joints shall be minimum #10 size galvanized.

2.9 SEALANTS

A. Duct sealant shall be water-based, non-fibrated, and fire resistive with a UL 181B listing for use on low, medium, and high pressure ductwork. Sealant VOC levels shall also meet all federal, state, and local requirements and be classified with mildew resistance per ASTM G21 with 0 growth rating.

B. Sealant shall be rated for up to 10" w.c. and shall be installed in strict accordance with the manufacturer's written instructions. Pressure sensitive tapes are not acceptable.

C. Subject to compliance with requirements, manufacturers offering sealants which may be incorporated in the work include the following:

Design Polymerics DP-1010
Hardcast Iron-Grip 601
Foster 32-19
Childers CP-146

2.10 FLEXIBLE DUCTS

A. Flexible ducts may be used in concealed areas where detailed and as specified.

B. Flexible ducts shall consist of an exterior reinforced laminated vapor barrier, 2 inch thick fiberglass insulation (R-6), encapsulated spring steel wire helix, and impervious, smooth, non-perforated interior vinyl liner. Each individual length of flexible duct shall include factory fabricated steel connection collars. Flexible ducts shall be UL approved and tested and shall meet Class 1 requirements of NFPA 90A.

C. Flexible ducts from rigid runouts to diffusers and registers shall be Thermaflex M-KE, or approved equal, with a maximum length of 5 feet.

D. Comply with all applicable portions of the Air Duct Council Flexible Duct Performance and Installation Standards.

2.11 CLOTHES DRYER EXHAUST DUCTWORK

A. Provide aluminum ducts sized as indicated on the drawings. Provide wall cap with backdraft damper at exterior wall where indicated on the drawings. Exhaust ducts shall be connected without using screws or other fastening means that extend inside the duct.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

A. Assemble and install ductwork to achieve air tight and noise-free (no objectionable noise) systems capable of performing each indicated service.

B. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling.

C. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.

D. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.

E. Support ductwork and piping in a manner complying with Section 230530 (Hangers and Supports for HVAC Piping and Equipment). Where special hanging of ductwork or piping is detailed or shown on drawings, the drawings shall be followed.

F. Duct hangers used in areas where a specialty architectural ceiling or floor occurs shall be compatible for use with that system. See architectural and structural drawings for locations.

G. Seal all ductwork to the seal class required in the following table, and using the methods prescribed in the SMACNA HVAC Air Duct Leakage Test Manual, latest edition.

Duct Class	Up to 2" w.c.	3" w.c.	4" thru 10" w.c. and/or exposed to weather
Seal Class	C	B	A
Sealing	Transverse Joints Only	Transverse Joints and Seams	Joints, Seams, and all Applicable Wall Penetrations
Leakage Class			
Rectangular Metal	16	8	4
Round Metal	8	4	2

1. Sealant shall be applied 3 inches wide and at 32 mil wet film thickness.
2. For ducts greater than 2" pressure class, or exposed to weather, a first layer of sealant shall be applied to an 18 mil thickness, with scrim applied over the sealant, and then another 18 mil thickness of sealant shall be applied over the scrim.

3.2 INSTALLATION OF FLEXIBLE DUCTWORK

A. Provide supports at or near the mid-length point using 2 inch wide 28 gauge steel hanger collars attached to the structure with an approved duct hanger. Installation shall eliminate sharp radius turns, offsets, or kinks.

B. Bends in flexible ductwork shall be kept to a minimum. The minimum bend radius shall be 1.5 times the duct diameter with no bends greater than 45 degrees. This specifications and any applicable drawings or details shall be strictly adhered to.

C. Each length of flexible duct shall be provided with steel connection collars.

D. Make connections to rigid duct and equipment with draw bands and sealer, and then apply duct tape over outside of sheath.

3.3 CLEANING AND PROTECTION OF DUCTWORK

A. Clean ductwork internally, unit by unit as it is installed, of any dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or where ductwork is to be painted.

B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at the time of ductwork installation, provide temporary closure using polyethylene film or other covering which will prevent entrance of dust and debris until the time that connections are to be completed.

3.4 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, and tools, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 31 10 - HVAC DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of ductwork accessories specified in this section include volume dampers, control dampers, fire-smoke dampers, turning vanes, duct hardware, duct access doors, flexible connections, and backdraft dampers.

1.3 QUALITY ASSURANCE

A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC Duct Construction Standards (Metal and Flexible) latest edition, for all work in this section.

B. ASHRAE Standards: Comply with American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommendations, latest edition, for all work in this section.

C. NFPA Compliance: Comply with ANSI/NFPA 90A (Standard for the Installation of Air Conditioning and Ventilating Systems) and ANSI/NFPA 90B (Standard for the Installation of Warm Air Heating and Air Conditioning Systems).

D. Compliance: Construct, test, install and label fire dampers and fire doors in accordance with Underwriters Laboratories (UL) Standard 555 (Fire Dampers and Ceiling Dampers).

E. Dampers shall be warranted against manufacturing defects for a period of 5 years.

F. Dampers shall be tested, rated and labeled in accordance with the latest requirements of UL 555 (Fire Dampers) and UL 555S (Smoke Dampers).

G. Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA 500.

H. Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA 500 and certified in accordance with AMCA 500D.

1.4 REFERENCES

AMCA 500D	Laboratory Test Methods for Testing Dampers for Ratings
AMCA 511	Certified Ratings Program for Air Control Devices
IBC	International Building Code
NFPA 80	Fire Doors and Other Opening Protectives
NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	Standard for the Installation of Warm Air Heating and Air Conditioning Systems
NFPA 92A	Smoke Control Systems
NFPA 101	Life Safety Code
NFPA 105	Standard for the Installation of Smoke Door Assemblies
UL 555	Standard for Safety; Fire Dampers
UL 555S	Standard for Safety; Smoke Dampers

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction, and installation instructions.

B. Fire-Smoke Dampers: Submit complete installation instructions for all types of fire damper to be used on this project, as part of main submittal.

PART 2 - PRODUCTS

2.1 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA HVAC Duct Construction Standards, latest edition.

B. Turning Vanes in Rectangular Duct Elbows: Turning vanes shall be provided in all rectangular duct elbows unless indicated otherwise on the drawings, such as in return air transfer ducts, where turning vanes shall not be installed. All turning vanes shall be SMACNA 'Large' (R=4.5"/SP=3.25"). Turning vanes in medium pressure ducts (3.0" w.c. or greater) shall be double thickness. Turning vanes in low pressure ducts (2.0" w.c. or less) with duct widths 30 inches and smaller shall be single thickness. Turning vanes in low pressure ducts (2.0" w.c. or less) with duct widths 32 inches and larger shall be double thickness.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering turning vanes which may be incorporated in the work include the following, or approved equal:

Anemostat
Airsan Corporation

2.2 DUCT HARDWARE

A. Provide duct hardware manufactured by one manufacturer for all items on project for the following:

1. Test Holes: Provide in ductwork at fan inlet and outlet and elsewhere as required. Plastic test plugs may only be used on low pressure ductwork (2" w.c. or less). Test holes installed in medium pressure ductwork (above 2" w.c.) and at outdoor equipment shall be covered with Ventlok Model 699 covers, or approved equal.
2. Quadrant Locks: Provide for each damper quadrant lock device on one end of shaft and end-bearing plate on other end. Provide extended quadrant locks and extended bearing plates for externally insulated ductwork.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct hardware which may be incorporated in the work include the following, or approved equal:

Ventfabrics
Ventlok by Ventfabrics

2.3 DUCT ACCESS DOORS

A. Provide airtight access doors in ducts and plenums for cleaning and repairs of fire dampers, control devices, etc. and where shown on the drawings. Access door size shall be duct width by duct height for all ducts under 24 inches. Minimum access door size shall be 8 inches by 8 inches. Ducts over 24 inches in diameter shall have 24 inch by 18 inch access doors.

B. Access doors shall be rated for the associated duct pressure (positive or negative).

C. Access doors in supply air and return air ducts shall be insulated as required to provide a minimum R-6.0 rating. Insulation shall be 25/50 rated in accordance with ASTM E84. Access doors in supply air and return air ducts shall be Ductmate Model FD, or approved equal.

D. Access doors in low pressure ductwork (3.0” w.c. and below) shall be hinged with cam latches, and a perimeter gasket.

E. Access doors in medium pressure ductwork (4.0” w.c. and above) shall be constructed with cam latches and a perimeter gasket.

F. Access doors in stainless steel ductwork shall be constructed of stainless steel.

G. Access doors in grease exhaust ducts shall be UL listed, shall be Ductmate Ultimate, or approved equal.

H. Access doors shall be permanently identified on the exterior by a permanent label with letters not less than 1/2 inch in height reading ‘Fire-Smoke Damper’ or as otherwise appropriate.

I. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct access doors which may be incorporated in the work include the following, or approved equal:

Ductmate
Best Access Doors
United McGill

2.4 FLEXIBLE CONNECTIONS

A. Furnish and install flexible connections at following locations:

At supply connection on all motorized heating and cooling equipment.
At return connection on all motorized heating and cooling equipment.
At duct connection on all exhaust fans.
Elsewhere as shown on the drawings.

B. Flexible connections are not required for curb-mounted or roof-mounted exhaust fans.

C. Flexible duct connections shall be preassembled flexible connectors constructed of coated glass fabric applied in accordance with manufacturer's recommendations. Width of flexible connections shall be sufficient to allow minimum of 2 inches of free space between two metal collars to be connected. Install sheet metal band completely around duct or fan outlet, at end of flexible connection. Fasten with metal screws through band and coated glass fabric. Space screws approximately 3 inches apart. Coated glass fabric shall be equal to Ventfabrics Ventglas with neoprene coating for use inside building and Ventlon with hypalon coating when exposed to weather.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering flexible connections which may be incorporated in the work include the following:

Ventfabrics
Thermaflex

2.5 DAMPERS (MANUAL, REMOTE POWERED, CONTROL, AND BACKDRAFT DAMPERS)

A. Manual Dampers: Provide manual volume dampers in all locations shown on the drawings. Dampers shall be single blade type or multi-blade type, constructed in accordance with the SMACNA HVAC Duct Construction Standards, latest edition. Round dampers shall be Greenheck Model MBDR-50, or approved equal. Rectangular dampers shall be Greenheck Model MBD-15, or approved equal. Shop-fabricated dampers are not acceptable.

B. Concealed Damper Actuators: Where dampers are installed above non-accessible ceilings and are not served by access doors, provide extension cables and concealed ceiling mounted damper regulators. Damper regulator shall be Young Regulator Model 270-896, or approved equal.

C. Remote Powered Balancing Dampers: Where indicated on the drawings, provide remote powered balancing dampers complete with motorized damper, connecting cable, and wall or ceiling plate with number of ports as indicated on the drawings. Dampers shall be Greenheck Model RBDR-50, Pottorff Model RD-10R, Young Regulator Model EBD, or approved equal.

D. Control Dampers: Provide dampers with low leakage opposed blades, frame and blades constructed of 16 gauge galvanized steel, suitable for electric actuators.

E. Backdraft Dampers: Provide dampers with parallel blades, constructed of 16 gauge aluminum; provide 1/2 inch diameter ball bearings, 1/2 inch diameter steel axles spaced on 9 inch centers. Construct frame of 2” x 1/2” x 1/8” thick steel channel for face areas 25 sf and under; and 4” x 1-1/4” x 16 gauge channel for face areas over 25 sf. Provide galvanized steel finish on frame with aluminum touch-up.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dampers which may be incorporated in the work include the following, or approved equal:

Greenheck
Pottorff
Young Regulator
Ruskin

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCT ACCESSORIES

A. Install duct accessories in accordance with the manufacturer's installation instructions, with applicable portions of details of construction as shown in the SMACNA Standards, and in accordance with recognized industry practices as necessary to ensure that the products serve the intended function.

B. Install turning vanes in square and/or rectangular 90 degree elbows in supply and exhaust air systems and elsewhere as indicated.

C. Install access doors to open against system air pressure, with latches operable from either side, except on the outside only where the duct is too small for a person to enter.

D. Coordinate with other work as necessary to interface installation of duct accessories properly with other work.

E. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories as required to obtain proper operation and leak-proof performance.

3.2 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to the Architect/Engineer. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.3 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.4 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 34 00 - HVAC FANS AND HOODS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of fans, hoods, and curbs specified in this section include the following:
   1. Ceiling Exhaust Fans

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of material listed in this section.

B. Operation and Maintenance Data: Submit operation and maintenance data and replacement material lists for each type of material listed in this section. Include this data and product data in the operation and maintenance manual.

PART 2 - PRODUCTS

2.1 CEILING EXHAUST FANS

A. Provide ceiling fans of type, size, and capacity as scheduled on the drawings, and as specified herein. Fans shall be Greenheck Model CSP-A, Greenheck Model SP-AP, or approved equal, with factory furnished speed control.

B. Fans shall be tested and rated in accordance with ASHRAE Standards. Provide with AMCA Certified Ratings Seal for both airflow and sound.

C. Motor Type: For belt drive fans, provide an open drip-proof (ODP) motor. Motor shall be permanently lubricated sleeve bearing type, mounted on vibration isolators, suitable for speed control. For direct drive fans, provide an EC motor with a factory furnished speed control.

D. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering ceiling exhaust fans which may be incorporated in the work include the following, or approved equal:

   Greenheck
   Cook

PART 3 - EXECUTION

3.1 GENERAL

A. Install fans and ventilators where indicated, in accordance with equipment manufacturer's installation instructions, and with recognized industry practices, to ensure that equipment complies with requirements and serves intended purposes.

B. Provide motors so that they cannot be overloaded above nameplate rating throughout the full speed range of the adjustable pitch driving sheave.

C. Fan wheels shall be balanced statically and dynamically near operating speed.

D. Provide drives and guards conforming to the requirements hereinbefore specified.

E. Fan construction, speed, noise level, tip speeds, outlet velocities, and efficiencies will be taken into consideration in assessment of all fans that are submitted.

3.2 ELECTRICAL CONNECTIONS

A. Ensure air distribution equipment is wired properly, with rotation in direction indicated and intended for proper performance.

3.3 CARE AND CLEANING

A. Repair or replace broken, damaged or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Owner's representative. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.4 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.5 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like and leave the premises clean, neat and orderly.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. This section includes specifications and requirements for air outlets and inlets.

1.3 QUALITY ASSURANCE

A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC Duct Construction Standards (Metal and Flexible), latest edition, for all work in this section.

B. ASHRAE Standards: Comply with American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommendations, latest edition, for all work in this section.

C. NFPA Compliance: Comply with ANSI/NFPA 90A ‘Standard for the Installation of Air Conditioning and Ventilating Systems’, and ANSI/NFPA 90B ‘Standard for the Installation of Warm Air Heating and Air Conditioning Systems’.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction, and installation instructions.

PART 2 - PRODUCTS

2.1 AIR OUTLETS AND INLETS

A. See air distribution schedule on the drawings for outlet and inlet types.

B. Grilles, registers, and diffusers shall be selected and guaranteed by the manufacturer to operate without objectionable noise or draft.

C. Furnish and install sponge rubber gaskets between grilles and grounds of finished surfaces. Wood grounds will be furnished by others. Metal grounds shall be furnished by the Contractor. Sidewall grilles and registers shall be provided with a dull/flat prime coat finish, unless noted otherwise. All supply diffusers, registers, and grilles located at ceilings shall have factory-applied bone white finish, unless indicated otherwise on the drawings.

D. Paint visible ductwork behind grilles, registers, and diffusers flat black.

E. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown of size, shape, capacity, and type indicated; constructed of materials and components as indicated and as required for a complete installation. Provide diffusers with border styles that are compatible with adjacent ceiling systems and that are specifically manufactured to fit into ceiling modules with accurate fit and adequate support. Refer to the architectural drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser and/or grille.

F. Allowable Manufacturers: Subject to compliance with requirements, manufacturers offering air outlets and inlets which may be incorporated in the work include the following, or approved equal:

Price
Krueger
Titus

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR OUTLETS AND INLETS

A. Install outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.

B. Locate ceiling air diffusers, registers, and grilles as indicated on reflected ceiling plans. Unless otherwise indicated, locate units in the center of acoustical ceiling modules.

C. Examine areas and conditions under which outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

D. Ceiling mounted air terminals or services shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.

E. Air terminals or services weighing not more than 56 pounds shall have two 12 gauge hangers connected from the air terminal or service to the structure above. These wires may be slack.

F. Air terminals or services weighing more than 56 pounds shall be supported directly from the structure above using submitted and approved hangers.

3.2 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect/Engineer. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.3 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.4 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 23 86 00 - SPLIT SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 230000 (Heating, Ventilating, and Air Conditioning) and 230500 (Basic Materials and Methods for HVAC Systems) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of units specified in this section include the following:

Split System Heat Pumps

1.3 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and identified with labels describing contents.

1. Three sets of spare air filters for each unit.

1.4 QUALITY ASSURANCE

A. ARI Compliance: Coil ratings shall be in conformance with the requirements of ARI Standard 410 (Forced-Circulation Air Cooling and Air Heating Coils).

B. Units shall be rated in accordance with Air Conditioning, Heating and Refrigeration Institute (AHRI) Standard 240 and bear the AHRI Certification label.

C. A dry air holding charge shall be provided in the indoor section.

D. The installing contractor shall have a minimum of 5 years of installation experience with the manufacturer’s product.

E. System startup supervision shall be provided by the equipment manufacturer’s representative or by an authorized representative that has been factory trained in system setup and operation.

F. Warranty: The units shall have a manufacturer’s parts and defects warranty for a period 5 years from the date of startup. The compressor shall have an extended warranty of 10 years from the date of startup. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of equipment and material listed in this section.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM HEAT PUMPS

A. General: Provide split system heat pumps having capacities, cabinet sizes, electrical characteristics, and accessories as scheduled on the drawings.

B. Capacity: Units shall be capable of heating at 0°F ambient and cooling at 100°F ambient with the capacities scheduled on the drawings. Units shall be capable of operating (at somewhat reduced capacities) at ambient air temperatures between -5°F and 115°F.

C. Outdoor Units
   1. The outdoor units shall have a thermally fused powder coated finish. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit shall be run tested at the factory.
   2. Outdoor unit shall have a sound rating no higher than 55 dB(A).
   3. Outdoor unit cabinets and mounting systems shall have a thermally fused polyester powder coat finish that meets the ASTM D3451-06 Standard.
   4. Outdoor units shall have a direct drive fan and the motor shall have permanently lubricated bearings.
   5. The outdoor unit shall be provided with manufacturer supplied wind baffles (if required to achieve the specified performance).
   6. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow/hail guard.
   7. Coil fins shall have a factory-applied corrosion resistant coating.
   8. The compressor shall be equipped with thermal overload protection.
   9. Units shall be equipped with a base pan heater to protect the coil against ice build-up during prolonged winter operation. The base pan heater shall activate only if the compressor is operating in heating mode at an outdoor temperature of 36°F or below.
   10. Units shall be 208 Volt, 1 phase, and shall have a local electrical disconnect.

D. Indoor Units
   1. The wall mounted indoor units shall be factory assembled, wired, and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, a 3 minute time delay mechanism, an auto restart function, and a test run switch.
   2. Multi-directional drain and refrigerant piping offering 4 directions for refrigerant piping and 2 directions for draining are required.
   3. An integral, motorized, multi-position, horizontal air sweep vane shall provide for uniform air distribution, both up and down. The vane(s) shall have selectable positions plus ‘Auto’ (control position based upon mode). The microprocessor shall automatically determine the vane angle to provide the optimum room temperature distribution) and vane swing (continuously moves up and down). In ‘Off’ mode the horizontal vane shall return to the closed position.
   4. The indoor unit shall include an ‘Auto’ fan setting capable of maximizing energy efficiency by adjusting the fan speed based on the difference between controller setpoint and room temperature. The indoor fan shall be capable of a minimum of 4 manual speed settings plus Auto.
   5. Return air shall be filtered by means of 2 easily removable, washable filters, and electrostatic anti-allergy enzyme filters.
   6. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil. Provide a factory-installed unit-powered condensate pump inside the cabinet. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil. A drain pan level switch, designed to connect to the control board, shall be provided and installed in the condensate pan to prevent condensate from overflowing.
   7. Indoor unit electrical power shall be 208 Volt, 1 phase, and shall be powered by the outdoor unit.
   8. The unit shall not have supplemental electric heat elements.

E. Controls: Provide wall-mounted, back-lit controllers, capable of system run/stop, operating mode selection (cool, auto, fan, heat), adjusting space temperature, fan speed, and air distribution, and displaying return air and indoor coil temperatures.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering split system air conditioning units which may be incorporated in the work include the following, or approved equal:

Daikin

2.2 REFRIGERANT PIPING

A. See Specification Section 232400 (Refrigerant Piping and Accessories).

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

3.2 ELECTRICAL WIRING

A. Install electrical devices furnished by the manufacturer but not specified to be factory mounted. Furnish a copy of the manufacturer's wiring diagram to the electrical contractor.

B. Route electrical power and control wiring in separate conduits.

3.3 REFRIGERANT PIPING INSTALLATION, TESTING, EVACUATION, AND CHARGING

A. See Specification Section 232400 (Refrigerant Piping and Accessories).

3.4 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.5 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.6 CLEANING UP

A. Upon completion of the Work remove materials, equipment, apparatus, tools, and the like, and leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 26 00 01 – ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General provisions of the Contract including the "General Conditions", "Supplementary Conditions", and "General Requirements" of the Contract as written and referred to here are adopted and made part of Division 26.

B. The Contract Agreement, Bidding documents, and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the electrical systems.

1.2 SUMMARY

A. The work under this Division shall consist of all labor, materials, equipment, services and related accessories, etc., necessary and required to complete all work as shown or inferred on the Drawings and in the Specifications (Contract Documents).

B. Provide fixed electrical equipment, except where specifically noted otherwise.

C. Provide portable electrical equipment for the complete system(s).

D. Provide equipment and/or wiring normally furnished or required for complete electrical systems but not specifically specified on the drawings and/or in specifications, as though specified by both.

E. All equipment and wiring shall be new, except where specifically shown or specified otherwise.

F. Provide flexible electrical conduit and conductors having a slack, 90-degree bend or loop in any plane between connections at all vibration isolated equipment and the first attachment to building structure or cabinets, panels or boxes mounted thereon.

1.3 WORK INCLUDED IN THIS DIVISION

A. Electrical work includes, but is not limited to
1. Arranging and coordinating with utility services required as shown or specified.
2. Installation of all utility conduit and infrastructure.
3. Removal or relocation of electrical services and electrical work located on or crossing through project property, above or below grade, obstructing construction of project or conflicting with completed project or any applicable code.
4. Provide meters, switchboards, panelboards, circuit breakers, power outlets, convenience outlets, switches, and/or other equipment forming part of system.
5. Complete lighting system.
6. Complete communication system.
7. Complete Audio/Visual system.
8. Connection of all appliances and equipment including Owner furnished equipment.
9. Complete grounding system.
10. Complete temporary facilities for construction power.
11. Complete fire alarm system.

1.4 WORK NOT INCLUDED IN THIS DIVISION (REFER TO OTHER DIVISIONS OF THESE SPECIFICATIONS)

A. Flashing of conduits into roofs and outside walls. Inform General Contractor of number and size of roof penetrations prior to bidding.

B. Furring of building structure or finishes for conduit and equipment.

C. Finish painting of conduit and equipment except for factory applied prime or finish painting specified for equipment, fixtures, devices or materials furnished under this section.

D. Installation of motors except where specifically noted. See Division 23.

E. Control wiring for mechanical systems, except where specifically indicated to be provided by Electrical Contractor. See Division 23.

1.5 RELATED WORK SPECIFIED ELSEWHERE

A. Classification of Excavation: Division 02 – Site work.

B. Concrete Work: Division 03.

C. Painting: Division 09.

D. Firestopping and Sealants: Division 07.

1.6 REFERENCES

NEC:	National Electrical Code (latest edition adopted by local authorities unless otherwise noted).
NFPA:	National Fire Protection Association.
OSHA:	Occupational Safety and Health Administration.
UL:	Underwriters Laboratories, Inc.
NEMA:	National Electrical Manufacturer's Association.
IEEE:	Institute of Electrical and Electronic Engineers.
ACI:	American Concrete Institute.
ADA:	American Disabilities Act.
ANSI:	American National Standards Institutes.
ASTM:	American Society for Testing Materials.
AWS:	American Welding Society.
FM:	Factory Mutual Insurance Association.
IBC:	International Building Code
IES:	Illumination Engineering Society.
ISA:	Instrument Society of America.
LPI	Lightning Protection Institute.
NACE:	National Association of Corrosion Engineers.
NETA:	International Electrical Testing Association.
UL:	Underwriters Laboratories.
NECA:	National Electrical Contractors Association
NETA:	National Electrical Testing Association.

1.7 ADOPTED CODES

A. 2024 International Building Code (IBC) Published by the International Code Council (ICC).

B. 2023 National Electrical Code (NEC) published by the National Fire Protection Association (NFPA)

C. 2024 International Fire Code (IFC) published by the International Code Council.

D. National Fire Codes (NFPA Standards) published by the National Fire Protection Association (NFPA) as referenced in the 2018 International Fire Code.

E. 2024 International Energy Conservation Code (IECC) published by the International Code Council. ASHRAE/IESNA Standard 90.1 is incorporated by reference.

F. All applicable provisions of the Nevada Revised Statutes (NRS) and the Nevada Administrative Code (NAC), including those listed below.

G. The most current regulations of the State Fire Marshal, Nevada Department of Public Safety, Carson City, Nevada (NAC Chapter 477, State Fire Marshal).

H. The most current edition of the Americans with Disabilities Act (ADA) published by the United States Department of Justice including the Americans with Disabilities Act Accessibility Guidelines (ADAAG)

I. Other codes, regulations, and standards referenced in the body of this document.

J. Local codes and ordinances do not apply to projects constructed on state-owned land, except for zoning requirements pursuant to Nevada Revised Statutes Section 278.580.

K. Northern Nevada ICC 2024 Adopted Amendments.

1.8 DEFINITIONS

Provide:	Furnish, install, connect and test until complete.
Wire:	Furnish all necessary wiring, connect and test until complete.
Install:	Furnish, set in place, wire and test until complete.
Work:	Materials completely installed, connected, and tested until complete.
AWG:	American Wire Gage.
Equal:	Acceptable equal as determined by the Engineer.

1.9 REQUIREMENTS OF REGULATORY AGENCIES

A. Obtain and pay for all permits and inspections required for the work. Comply with all ordinances pertaining to work described herein. Pay all expenses arising from the procurement of these certificates and include in the base contract price.

B. Install work under this Division per drawings, specifications, latest adopted edition of the National Electrical Code, (NFPA-70) including local amendments and interpretations, Local adopted Building Codes, and any special codes having jurisdiction over specific portions of work within complete installation. In event of conflict, install work per most stringent code requirements determined by Engineer. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such ordinances, laws, regulations and codes.

C. All materials, products, devices, fixtures, forms or types of construction included in this project shall meet or exceed the published requirements of National Electrical Code (NEC), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE) and National Electrical Manufacturers Associations (NEMA). All equipment shall bear the Underwriter's Laboratories (UL) label or equivalent from approved independent testing laboratory.

D. Arrange, pay fees for and complete work to pass required tests by agencies having authority over work. Deliver to Engineer copies of the Certificates of Inspection and approval issued by authorities and provide original copy of each certificate to Owner.

E. When required by law or regulations, the governmental agency having jurisdiction for inspections shall be given reasonable notice and opportunity to inspect the work. Any work that is enclosed or covered up before such inspection and test shall be uncovered at the Contractor's expense; after it has been inspected, the Contractor shall restore the work to its original condition at his own expense.

1.10 INSURANCE

A. The Contractor shall procure and maintain, at his expense, such insurance as required by law and/or specified in the General Conditions.

1.11 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are complementary. Work called for by one is binding as if called for by both. Any discrepancies between drawings and specifications shall be brought to the attention of the Engineer for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of his failure to have brought said discrepancies to the attention of the Consultant during the bidding period or by reason of any error on the Contractor's part.

B. Drawings are schematic and diagrammatic in nature. Drawings show general run of circuits and approximate location of equipment. The contractor shall review drawings of all trades to assure coordination prior to placement of work. Right is reserved to change location of equipment and devices, and routing of conduits within 10 feet, without extra cost to Owner (prior to rough-in).

C. Use dimensions in figures, shop drawings, etc. and actual site measurements in preference to scaled dimensions. Do not scale drawings for exact sizes or locations – use dimensioned details or actual field conditions. Verify item mounting heights as required by project conditions prior to rough-in.

D. The architectural drawings shall take precedence over all other drawings in matters of dimensions. Discrepancies between different drawings or between drawings and specifications, or regulations and codes governing the installation shall be brought to the attention of the Engineer in writing for determination.

E. Layout equipment as shown on drawings as close as possible. Verify access requirements for equipment actually furnished, and adjust layout to comply with NEC 110. Right is reserved to change layout within 10 feet without additional cost (prior to rough-in).

F. All devices, light fixtures, etc. located in ceiling tiles shall be located in the center of the ceiling tile UNLESS specifically noted or approved to do otherwise.

G. The Contractor is responsible to field measure and confirm the mounting heights and location of electrical equipment with respect to counters, doorways, and other architectural, mechanical or structural work. Do not scale distances off the electrical drawings: Use actual building dimensions.

H. Execution of Contract is evidence that Contractor has examined all existing conditions, drawings and specifications related to work, and is informed to extent and character of work. Later claims for labor and materials required due to difficulties encountered, which could have been foreseen had examination been made, will not be recognized.

I. All work called for in this Section of the plans and specifications shall be performed under this Section, regardless of whether such work may also have been called for in other Section(s). Discrepancies in or conflicts among the various parts of the contract drawings shall not relieve Contractor of his obligation to perform.

J. No attempt has been made to establish the required sections or splits of equipment relative to the size of access into the space, building, etc. Contractor shall establish all said splits, sections, etc. necessary to install equipment complete without undue disassembly of equipment or demolition of building parts at site of work.

K. Charges for extra work are not allowed unless work is authorized by written order from the Owner's Representative approving charges for work.

L. Check all door swings so light switches are not located behind doors. Relocate switches as required with the Engineer's review.

M. Elevators: The location of switches, GFCI receptacles, lights, telephone outlets, disconnect switches, fire alarm devices, etc., in elevator pits, shafts, equipment rooms shall be located as required by the Elevator Shop Drawings and applicable codes. Coordinate size and type of all electrical devices with Elevator Contractor prior to purchase of equipment.

1.12 SEISMIC QUALIFICATIONS & REQUIREMENTS

A. Equipment Seismic Qualification

Major equipment and components shall be suitable for and certified to meet all applicable seismic requirements of the California Building Code (CBC) through zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, CBC: a peak of 2.15g's and a ZPA of 0.86g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

B. Structural Design Requirements

1. Include in the bid, hiring of a structural engineer, registered in the state of Nevada, to provide calculations and details for equipment pads and mounting and bracing of all major equipment. Attach equipment according to those calculations.
2. Major equipment and components include:
   a) Conduit racks and supports.
   b) Transformers.
   c) Panelboards.
   d) Service and Distribution switchboards.
3. Equipment anchoring and bracing shall be designed to conform to IBC 2018 and NRS 341.143.

C. See Spec Section 26 05 30 Seismic Protection for Electrical Equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All material shall be new, and have a UL label where available. If UL label is not available, material shall be manufactured in accordance with applicable NEMA, IEEE and Federal Standards. Use UL labeled components in assemblies that do not have overall UL label. All equipment shall comply with the terms “listed and labeled” as defined in the NEC 70, Article 100. Submit letter stating compliance with these requirements.

B. Utilize one of the manufacturers listed to furnish all of the major equipment (i.e., transformers, bus duct, switchgear, circuit breakers, etc.) required for this project.

C. In all cases, there is one basis of design manufacturer or product for each item of equipment or product shown on the drawings and/or specified herein. These products are identified by name and model number on the drawings and/or in the specifications. Alternative manufacturers and products are also listed; however their inclusion as an alternative manufacturer or product does not cause them to be the basis of design. If an alternative manufacturer and/or product is desired to be used by the Contractor, it will be considered a substitution. Substitutions will be interpreted to be all manufacturers or products other than the basis of design. Only one request for substitution will be considered for each item of material or equipment. No substitutions will be considered thereafter. After a substitution request is reviewed and is found to be unacceptable the Architect/Engineer reserves the right to require the originally specified equipment or product at no additional cost to the Owner.

D. In any case where the Contractor intends to utilize a listed or unlisted acceptable equipment manufacturer that is not the basis of design as listed on the drawings and in the specifications, it is the Contractor’s responsibility to confirm prior to bidding that all ductwork, piping, controls, electrical power, conduit, service clearances, space requirements, and structural requirements match those of the basis of design equipment. Costs for any revisions necessary to accommodate the ductwork, piping, controls, electrical power, conduit, service clearances, space requirements, and structural requirements for the alternative equipment are the responsibility of the Contractor and shall be included in the Contractor’s bid, this includes any costs associated with re-design or necessary calculations by the project Architect or Engineers. No extra cost will be allowed for failure to allow for accommodations related to the alternative equipment in the Contractor’s bid.

E. Submit to the Architect/Engineer for review, within a reasonable time after award of Contract and in ample time to avoid delay of construction, shop drawings or submittals on all items of equipment and materials, including all substitutions. Also see Division 1 for additional related requirements.

F. If the Contractor desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified. No substitutions will be allowed unless requested and reviewed in writing. The Architect/Engineer will review and take appropriate action on shop drawings, product data, samples, and other submittals as required by the contract documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the contract documents. The review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor. Review of a specific

item shall not indicate acceptance of an assembly of which the item is a component. The Architect/Engineer shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the Contractor, nor shall the Architect/Engineer be required to review partial submissions or those for which submissions for correlated items have not been received. The Architect/Engineer reserves the right to require the originally specified item at no additional cost to the Owner.

G. Installation of reviewed substitutions is the Contractor's responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the Owner. Review by the Architect/Engineer of the substituted equipment and/or the dimensioned drawings does not waive the requirements stated herein.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION

3.1 VISIT TO SITE

A. Visit site, and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the electrical work, including relocation of existing services and utilities on building site in bid. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference's shall be reported immediately to the Engineer.

3.2 WORKMANSHIP

A. All work performed shall be first class work in every aspect. The work shall be performed by mechanics skilled in their respective trades, who shall at all times be under the supervision of competent persons. All work shall be installed to comply with NECA's "Standard of Installation."

B. Work under this Division shall be first class with emphasis on neatness and workmanship. All work shall be installed square and plumb and concealed where possible. Work that is deficient, defective, poorly laid out, not perfectly aligned, or that is not consistent with the requirements generally accepted in the trade for "first class work" will not be acceptable.

C. In addition to the materials specified elsewhere, furnish and install all other miscellaneous items necessary for the completion of the work to the extent that all systems are complete and operative.

D. All work under this Section shall be performed in cooperation with the work performed under all other Sections of the Specifications for the Project in order to avoid interference with other work and to secure the proper installation of all work. Refer the Drawings and Specifications covering

the work to be performed under all Sections, so that the relation and extent of the work of this Section with respect to the work of all other Sections is understood. Give right of way to raceways and piping systems installed at a required slope.

E. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. The installation shall be subject to the Engineer's observation, and final acceptance. The Engineer may reject unsuitable work.

F. Conduit systems must be complete prior to installation of wiring.

3.3 CHANGE ORDERS

A. Additional work may be required on the project which is outside the scope of the contract. Such additional work will be described in Supplemental Instructions and/or Clarifications, to be estimated and priced by the Contractor, and accepted by the Owner, prior to commencing work. Proposals shall include a list of quantities of all material being used with unit costs broken down into material and labor costs per unit, along with quotations from suppliers for equipment/devices/components.

B. Material costs and labor units shall not exceed the latest edition of RS Means Electrical Cost Data.

C. See the General Conditions of the Specifications for acceptable charges.

3.4 GUARANTEE

A. Furnish the Owner a written guarantee, stating that if workmanship and/or material executed under this Division is proven defective within one (1) year after final acceptance by the Owner, such defects and other work damaged will be repaired and/or replaced. Submit with Operations and Maintenance Manuals.

B. Obtain from the various manufacturers or vendors guarantees or warranties for their particular equipment or components, and deliver them to the Owner. All guarantees and warranties provided shall be referenced to this project.

C. In event that systems are placed in operation in several phases at the Owner's request, guarantee will begin on date each system or item of equipment is accepted for service by the Owner. Provide O&M manuals for all equipment when equipment is accepted for service by the Owner.

D. All guarantees and warranties shall include labor and material at the site of installation for the duration of the guarantee period.

3.5 OBSERVATIONS OF WORK AND DEMONSTRATION OF OPERATION (ACCEPTANCE)

A. At all observations of work, open panel covers, junction box covers, pull box covers, device covers, and other equipment with removable plates for observation. Provide sufficient personnel to expedite cover removal and replacement.

B. Contractor to demonstrate operation of new equipment and/or systems to satisfaction of Owner/Engineer. Contractor to have manufacturer available for demonstration of equipment and/or systems where requested by Owner/Engineer. Furnish affidavit signed by Owner's representative indicating that demonstration of operation has been performed.

3.6 COOPERATION AND COORDINATION

A. Carefully coordinate work with other contractors and subcontractors. Refer conflicts between trades to Engineer. Provide necessary information to other trades for such coordination. Such information shall include Shop Drawings, Product Data and all other required data. There shall be no additional cost to the owner for any post-bid changes made to the electrical design and/or construction that are generated by changes to the basis-of-design equipment of any discipline. This includes changes made by substituted, alternate or comparable products regardless of manufacturer.

B. Provide a system erection/coordination drawing showing electrical, HVAC, plumbing and architectural for installation in congested areas. Drawings shall be in plan view for work above the ceilings and also sections shall be provided showing the elevations of conduit racks and routing and the coordination with mechanical piping and ductwork.

C. Whenever such information is not provided in a timely manner or whenever such information is incorrect, this contractor shall bear all costs for providing or correcting affected work of related trades with no change to the Contract Price or Construction Schedule.

D. Work to be installed as progress of project will allow. Schedule of work determined by General Contractor, Owner, and/or Architect/Engineer.

3.7 COORDINATION OF UTILITY SERVICES

A. Drawings indicate proposed service layouts. The Contractor shall provide and install all concrete structures, pads, pullboxes, vaults, trenching, raceways, protective bollards, etc., as required per NV Energy standards.

3.8 HVAC CONTROL WIRING

A. Control Wiring including low voltage and line voltage interlock wiring will be furnished and installed under Division 23, except where specifically shown otherwise. Carefully coordinate power and control wiring interface.

B. This Contractor shall obtain from Division 23 all wiring diagrams associated with the HVAC work and furnish all power and 120V control wiring, disconnects and starters for equipment not already packaged with these items. All wiring and conduit associated with the HVAC Temperature Control System is included under Division 23. Wiring and conduit shall comply with Division 26. All electrical work associated with the HVAC system shall be done under the supervision of Division 23.

3.9 STARTERS

A. Separately mounted starters are furnished and installed under Division 26 unless specifically shown otherwise. All power wiring, fuses, thermal overloads, and disconnect switches and connection of all motors is under this division. Provide the proper feeders and connections as recommended by the manufacturer of the equipment. See Spec Section 26 29 13 Enclosed Controllers.

3.10 PROTECTING

A. Provide warning lights, bracing, shoring, rails, guards and covers necessary to prevent damage or injury. All persons working around electrical equipment shall have electrical shock and flash protection per OSHA 1910.301-309 & 331-335.

B. Do not leave exposed or unprotected, electrical items carrying current. Protect visitors and workers from exposure to contact with electrically energized surfaces, parts, etc. in accordance with OSHA standards.

3.11 DELIVERY, STORAGE AND HANDLING

A. Deliver equipment and materials to job site in original, unopened, labeled container. Products shall be properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification. Store to prevent damage and injury. Store materials to prevent corroding. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters. Contractor shall verify the availability of on site storage space, if no on site storage space is available then the contractor shall cover the cost for off site storage. Materials stored at the project site that becomes soiled with construction dirt, concrete, or moisture shall be removed from the site and replaced with new. Do not install soiled material.

B. Protect work and materials from damage by weather, entrance of water or dirt. Cap and mark conduit during installation.

C. Avoid damage to materials and equipment in place. Repair, or remove and replace damaged work and materials.

D. Protection and safekeeping of products stored on premises is responsibility of Contractor supplying products.

E. Schedule of deliveries and unloading to prevent traffic congestion blocking of access or interference with work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.

F. Install equipment per manufacturer's recommendations. Conflicts between contract documents and these recommendations shall be referred to Engineer for remedy.

G. Electrical or electronic equipment that has been damaged, exposed to weather or is, in the opinion of the Engineer or Architect, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

3.12 ANCHORS

A. Provide anchors for all equipment, raceways, hangers, etc. to safely support weight of item involved plus 100% for dead loads. Live loads shall be considered in addition to dead loads.

B. Anchors to consist of expansion type devices similar to "Redhead" or lead expansion anchors. Plastic anchors are not acceptable.

C. Use preset anchor steel inserts in concrete slabs. Provide preset anchor size and type for anticipated or specified rod/bolt size and live/dead load.

3.13 CLEANING AND PAINTING

A. Clean equipment furnished in this Division after completion of work. Clean wipe the interior of all conduit, pullboxes, junction boxes, outlet boxes, and panelboard backboxes, soiled with dirt and debris prior to installation of wiring.

B. Touch-up or re-paint damaged painted finishes as determined by the Engineer.

C. Remove debris, packing cartons, scrap, etc., from site daily.

3.14 SPARE PARTS

A. Where spare parts are specified in the Technical Sections, furnish spare parts to Owner with itemized receipt. Contractor is responsible to deliver parts and have receipt signed by Owner's representative. Turn over receipt with as-built documents.

3.15 HOUSEKEEPING PADS

A. Furnish 2500 # concrete pads, 4” high (interior locations) or 6” high (exterior locations) unless otherwise noted, for all freestanding equipment, i.e.: switchboards, panels, control panels, motor control centers, transformers, etc. Pads shall have 1" x 45° chamfered edges, and shall extend 2” to 4" beyond equipment mountings.

3.16 TRAINING

A. Training for operation and maintenance of new systems or modifications to existing systems is specified in Technical sections. Contractor shall submit with record documents an itemized receipt signed by Owner’s representative that all specified training has been received.

3.17 ACCESS PANELS

A. The contractor shall furnish all access panels for walls, partitions, etc., and shall give access panel to the General Contractor for installation at locations as directed by the Electrical Contractor. It shall be the responsibility of the Electrical Contractor that access panels are provided for access to all boxes, bus joints, equipment, etc., which may be concealed by building construction to comply with the NEC and NFPA. Access panels shall be installed so as not to interfere with lighting arrangements.

3.18 CONDUIT ROUTING

A. All penetrations through slab-on-grade and concrete-filled metal decks to be sealed watertight. See Section 07 92 00 – Joint Sealants.

END OF SECTION 26 00 01

SECTION 26 00 02 – ELECTRICAL SUBMITTALS

PART 1 – GENERAL

1.1 DESCRIPTION OF SUBMITTAL CATEGORIES

A. The required submittals are defined below and specified in each section.
1. Requests for substitutions are written requests to use materials, equipment, etc., different from that specified.
2. Shop Drawings include fabrication, layout, wiring diagrams, erection, setting, coordination, drawings and diagrams and performance data.
3. Samples are units of work, materials or equipment items, showing the workmanship, pattern, trim and similar qualities proposed.
4. Manufacturer's Data is standard printed product information concerning the standard portions of the manufacturer's products.
5. Certifications are written statements, executed specifically for the project application by an authorized officer of the contracting firm, manufacturer, or other firm as designated, certifying to compliance with the specified requirements.
6. Test Reports are specific reports prepared by independent testing laboratories, showing the results of specified testing.
7. Industry Standards are printed copies of the current standards in the industry.
8. Manufacturer's Product Warranties are manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed by the manufacturer if the product fails under certain conditions and times limits.
9. Operating Instructions are the written instructions by the manufacturer, fabricator or installer of equipment or systems, detailing the procedures to be followed by the Owner’s in operation, control and shut-down.
10. Maintenance Manuals are the compiled information provided for the Owner’s maintenance of each system of operating equipment.
11. Maintenance Materials (spare parts) are extra stock of parts or materials for the Owner's initial use in maintaining the equipment and systems in operation.
12. Record Drawings are accurate representations of the installed systems and wiring as recorded on a daily “as-installed” basis.
13. Guarantees are signed commitments to the Owner that certain acts of restitution will be performed if certain portions of work fail within certain conditions and time limits.
14. Product Data includes manufacturer's data pertaining to the products, materials and equipment of the work.
15. Method of Procedures are detailed sequences of work required during interruption of service and/or connection to energized parts of systems requiring special sequences or protections.
16. Training – Materials and sign-off of completion.
17. Identification nomenclature – See section 26 05 53.

PART 2 – PRODUCTS

2.1 PROPOSED MATERIAL MANUFACTURERS

A. Submit to Consultant within 30 days after award of contract a complete list of proposed material manufacturers. List does not preclude submission of shop drawings. Acceptance of manufacturer on list does not constitute acceptance of specific material or equipment. If shop drawings are submitted with non approved substitutions, the contractor will pay the expense incurred by the consultant to review the shop drawings of any re-submittal.

PART 3 – EXECUTION

3.1 SUBSTITUTIONS

A. See General Conditions of the specifications for information regarding substitutions. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples if requested by Engineer are provided. Alternate products shall meet or exceed design criteria.

3.2 SUBMITTAL FORM AND PROCEDURES

A. Shop and Erection Drawings
1. Submit shop drawings for material and equipment furnished under Division 26 of specifications, to Consultant for review within 30 days after award of contract. Shop drawings shall be submitted on timely basis to allow adequate lead time for review, re-submission if necessary, manufacture and delivery to allow access of material to project at correct time based on schedule established by Consultant/Contractor. Provide index with thumb tabs collated with Table of Contents for sections. Include complete descriptive data with dimensions, operating data and weight for each item of equipment. Carefully examine shop drawings to assure compliance with drawings and specifications prior to submittal to Consultant. **Shop drawings and submittals shall bear the stamp of approval of the Electrical Contractor as evidence that they have checked the drawings.** Drawing submitted without this stamp of approval will not be considered and will be returned for proper re-submission. All shop drawings shall be submitted as a single one time complete package. Partial packages shall not be reviewed.
2. Submit format per general project conditions.
3. **Clearly mark each shop drawing item to correspond to drawings and specifications. Any drawings not clearly marked will be rejected.**
4. Review of shop drawings does not relieve Contractor of responsibility for errors and omissions in shop drawings. Contractor is responsible for dimensions and sizes of equipment. Inform Engineer in writing of equipment differing from that specified.

B. "Record" Drawings
1. One complete set of prints will be furnished to the Contractor to indicate actual location of conduit systems, outlets, and equipment. Keep set of prints on job and record day to day changes to Contract drawings with red pencil. Provide “Record" drawings as specified in the General Conditions or Division 01 of the specifications at the completion of job.

C. Maintenance Materials
1. Submit a list of all warranties and guarantees.
2. Submit with final close out documents a signed receipt for all maintenance materials (spare parts) specified. See Technical Sections for required materials.

D. Product Warranties and Guarantees
1. Submit fully executed Product Warranties and Contractor Guarantees to the Owner with final close out documents.

E. Maintenance Manuals
1. Submit to Consultant data prepared by manufacturer for each item and/or device of electrical equipment furnished in this contract completely describing and identifying equipment. Data to include serial numbers, catalog/model numbers, parts lists, description of operation, final shop drawings, wiring diagrams, all electrical ratings, set-up and maintenance procedures and other literature required for maintenance of equipment. See Technical Sections for other required information.

Summary of Project Closeout Items for Owner

2. Certificates of inspection and approval from authorities having jurisdiction.
3. Executed Guarantees and Product Warranties.
4. “Record” drawings.
5. Final shop drawings.
6. Final Erection drawings.
7. Receipt for maintenance materials (spare parts).
7. Maintenance manuals.
8. Receipt for keys.
9. Completed test reports.
10. Signed off observation and punch lists.
11. Lien waivers.

3.3 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop drawings shall include, but not be limited to the following:

1. Shall be drawn to accurate scale except where diagrammatic representations are specifically indicated.
2. Shall show clearance dimensions of critical locations and show dimensions of spaces required for operation and maintenance of equipment.
3. Shall show conduit and conductor connections and other service connections.
4. Shall show interfaces with other work including structural support.
5. Shall include complete descriptive data, with dimensions, operating data and weight.
6. Shall indicate deviation from the contract documents.
7. Shall explain deviations.
8. Shall show short circuit current ratings for all electrical equipment.
9. Shall show how deviations coordinate with portions of the work, currently or previously submitted.

B. Review of shop drawings shall not relieve Contractor of responsibility for errors or omissions in shop drawings. Any equipment that will not fit into space shown on drawings shall be called to the attention of the Engineer in writing.

C. Samples: Submit samples where requested by Engineer. Engineer’s review of sample submittals

1. Shall be limited to general type, pattern and finish.
2. Shall not include testing and inspection of the submitted samples.
3. Shall not indicate complete compliance with specified requirements. Complete compliance with specifications is the exclusive responsibility of the Contractor.

D. Manufacturer's Data

1. Where pre-printed data covers more than one distinct item, mark copy to *clearly* indicate which item is to be provided.
2. Contractor shall delete portions of data not applicable.
3. Contractor shall mark data showing portion of operating range required for project application.
4. Elaboration of standard data describing a non-standard product shall be processed as a shop drawing.
5. For each product Contractor shall include the following information summarized into a single sheet document for each product
    a) Manufacturer's production specifications including catalog/model number.
    b) Manufacturer’s Serial Number.
    c) Installation or fabrication instructions.
    d) Source of supply.
    e) Sizes, weights, speeds and operating capacities.
    f) All electrical ratings, including temperature rating of terminals.
    g) Conduit and wire connection sizes and locations.
    h) All thermal ratings.

i) Statements of compliance with required standard and governing regulations.
j) Cooling requirements and makeup and/or ventilating air requirements.
k) Performance data, where applicable.
l) All sound ratings.
m) Other information needed to confirm compliance.
n) Manufacturers recommended parts list.
o) Other information required by Technical Sections.

E. Source Codes: Provide Source Code in both electronic and paper format and Source Code Licenses for all equipment that is computer driven. Provide Development licenses so Source Code can be examined, modified, and maintained. These Development Licenses, along with all software licenses shall become property of the Owner. At the discretion of the owner, third parties will be allowed to use the software as necessary, for the life of the work in this project. No encryption or other obfuscation will be allowed.

F. Certifications: Contractor shall submit with notarized execution.

G. Test Reports: Submit notarized test reports signed and dated by firm performing test.

H. Manufacturer's Product Warranties: Contractor shall submit product warranties in accordance with the technical sections. Where published warranty includes deviation from required warranty, product is disqualified from use on project, unless manufacturer issues a specific project warranty.

I. Operating Instructions required
1. Submit manufacturer's operating instructions for each item of electrical equipment.
2. Submit supplement with additional project application instructions where necessary.
3. Submit specific operating instructions for each electrical system that involves multiple items of equipment.
4. Submit instructions for charging, start-up, control or sequencing of operation, phase or seasonal variations, shut-down, safety and similar operations.
5. All operating instructions shall be typewritten in completely explained and easily understood English language.

J. Maintenance Manual Requirements
1. Provide emergency instructions including addresses and telephone numbers for service sources.
2. Provide regular system maintenance procedures.
3. Indicate proper use of tools and accessories.
4. Provide wiring and control diagram for each system.
5. Provide manufacturer's data for each operational item in each system.
6. Provide source code submittal for all software controlled equipment.
7. Provide manufacturer's product warranties, and guarantee relating to the system and equipment items in the system.
8. Provide Final Shop and Erection drawings relating to the system.
9. Bind each operating and maintenance manual in one or more vinyl-covered, 2” 3-ring binders, plus pocket-folders for folded drawings. Index with thumb tab collated with Table of Contents for sections. Mark the back spine and front cover of each binder with system identification and volume number.

K. Maintenance Materials: Deliver all materials to the Owner in fully identified containers or packages suitable for storage. Obtain receipt for all delivered materials signed by the Owner’s Representative.

L. Guarantees: Where indicated as "Certified", provide guarantee which, in addition to execution by an authorized officer of each guarantor, is attested to by the Secretary of each

guarantor and bears the corporate seal. Submit draft of each guarantee prior to execution.

END OF SECTION 26 00 02

SECTION 26 00 03 – TEMPORARY ELECTRICAL FACILITIES FOR CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish temporary electrical facilities to provide lighting and power for construction. Temporary power must be installed in accordance with the National Electrical Code, National Electrical Safety Code, local utility, local codes and authority having jurisdiction.

B. Coordinate temporary electrical facilities with other trades.

C. See General Conditions, Supplemental General Conditions and Spec Section 01 50 00, Temporary Facilities and Controls for additional information.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General: Provide new or used materials and equipment suitable for intended use. Ensure safe, adequate performance of facilities in accordance with governing regulations. Used equipment shall be in good, safe working order.

PART 3 - EXECUTION

3.1 INSTALLATION AND OPERATION

A. Except for self-contained facilities, connect and terminate temporary electrical facilities at locations required for proper distribution.

B. Do not subject electrical facilities on either temporary work or temporary use of permanent work to excess demand or overload.

C. All conduit and wiring used for temporary purposes shall be routed as to not damage any permanent finish or surface within the building. All surfaces shall be patched and repaired to that of a new finish.

3.2 SERVICE CONNECTION

A. Obtain temporary service from NV Energy. Install service in conformance with NEC 230 and 590.

3.3 GROUNDING

A. Power service and distribution system shall be properly grounded in accordance with NEC requirements.

B. Ground the system neutral in accordance with NEC 250.

C. Provide feeders and branch circuits with ground wire sized per NEC 250-122**.**

3.4 POWER SYSTEM AND DISTRIBUTION

A. Provide required distribution and capacity of system. Over-current protection, fusible and/or circuit breakers sized per NEC.

B. For 120/240 volts, single-phase system; use 3-wire 120/240-volt feeders and branch circuits.

C. For 120/208 volt, 3 phase, 4-wire system; use 120/208 volt balanced single-phase 3-wire distribution or 120/208 volts, 3 phase, 4-wire distribution.

D. For 480 volt, 3 phase, 3-wire distribution system; use balanced 2-wire single phase or 3-wire, 3 phase feeders for step-down to 120/240 volt or 120/208 volt utilization.

E. For 277/480 volt distribution system; use balanced 2-wire single phase or 3 and 4-wire, 3 phase feeders for step-down to 120/240 volt or 120/208 volt utilization.

F. Step-down transformers inside building shall be dry-type construction; protect from weather and construction damage.

G. Use No. 12 wire for branch circuits less than 100 feet to last outlet, and No. 10 wire for circuits beyond 100 feet. Install branch circuits using NEC approved wiring methods.

H. Balance loads connected to 3 phase services within reasonable limits.

3.5 PLUG-IN RECEPTACLES

A. Use 20A, duplex, NEMA grounded type or as required for special equipment.

B. Branch circuits feeding receptacles shall be 20A or as required for special equipment.

C. Provide receptacles to be reached by 50-foot extension cord.

D. All receptacle circuits shall be protected by dynamic type ground-fault circuit interrupters, which automatically disconnect circuit when leakage current of 4-6MA is detected.

E. Receptacles shall not be placed on the same circuit with temporary lighting.

3.6 TEMPORARY LUMINARIES

A. Provide luminaries approved by NEC for temporary construction wiring.

B. Lamps shall be rough service incandescent 150 watt to 300 watt equipped with guards to protect from contact and damage (sizes as directed).

3.7 LAMPS AND REPLACEMENTS

A. Provide lamps.

B. Replace burned out lamps to maintain required lighting levels throughout the duration of the project.

3.8 INSTALLATION OF CIRCUITS

A. Install required lighting and receptacle circuits along a route least objectionable to construction work as determined by Contractor. Protect circuits where exposed to damage.

3.9 PERMANENT WIRING SYSTEM

A. Do not use permanent wiring for construction without specific acceptance of the Owner. Before using permanent wiring for temporary service, submit a list of uses to the Owner. The Owner may refuse use of permanent equipment for temporary service. Use of permanent equipment prior to Substantial Completion shall not affect warranty period.

3.10 REMOVAL AND RESTORATION

A. Temporary wiring shall be removed immediately upon completion of construction or purpose for which the wiring was installed. Repair or replace work damaged by temporary electrical facilities. Clean and restore permanent electrical system used to provide temporary services to condition of new and unused work. Patch and seal all penetrations.
   1. Electrical work installed as temporary facilities, upon removal, remains property of Installer.
   2. Replace lamps of permanent light fixtures used for temporary lighting that have burned out or are noticeable dim. All permanently installed fixtures in the construction area lamps shall be removed and cleaned.
   3. Where temporary use of lamps exceeds 50 percent of lamp life, replace lamps.

B. At Substantial Completion, clean permanent electrical work used as temporary facilities. Remove debris accumulated in electrical spaces.

END OF SECTION 26 00 03

SECTION 26 05 03 – EQUIPMENT WIRING CONNECTIONS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

B. Related Sections:
1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Submittal procedures.

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

A. General Conditions: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 CORD AND PLUGS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

C. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 – EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations and to motors.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 ADJUSTING

A. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION 26 05 03

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building wire and cable and wiring connectors and connections.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.
   2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriters Laboratories, Inc.:
   1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Solid conductor for feeders and branch circuits 12 AWG and smaller.
   2. Stranded conductors for feeders and branch circuits 10 AWG and larger.
   3. Stranded conductors for control circuits.
   4. Conductor not smaller than 12 AWG for power and lighting circuits.
   5. Conductor not smaller than 16 AWG for control circuits.
   6. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent. See section 3.3-W for receptacle and lighting branch circuits. Utilize loads shown in panel schedules for all other load types to maintain maximum 3% voltage drop.

B. Wiring Methods: Provide the following wiring methods:
   1. All Locations Unless Noted Otherwise: Use only building wire, Type THHN/THWN or XHHW insulation, in raceway.

1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper, aluminum conductors are not acceptable.

1.5 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Product Data: Submit for building wire.

C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.

D. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

A. General Conditions: Requirements for coordination.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Product Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 90 degrees C.

E. Insulation Material: Thermoplastic.

2.2 ARMORED CABLE

A. Type AC Cable may not be used on this project.

2.3 METAL CLAD CABLE

A. Type MC Cable may not be used on this project and is strictly prohibited.

2.4 CONNECTORS AND SPLICES

A. Provide UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, type and class for application and for service indicated. Select connectors to comply with Project's installation requirements and as specified in Part 3 "Applications" of this Article.

B. For Conductors #10 AWG and Smaller: Wire and cable connectors shall be solderless, twist on, 600 volts, 105°C., shall comply with UL 486A/C standards. Connectors coded for easy selection compatible with wiring to be spliced. Install connectors as recommended by manufacturer. Use proper crimping tool where crimp sleeves are used.
1. Acceptable Connector Manufacturers
    a) 3M- "Scotchlock"
    b) Buchanan - "B Cap"
    c) Thomas & Betts - "Stak-On"
    d) Ideal - "Wing Nuts"

C. Compression Splices: Splice conductors #8 and larger with solid copper barrel, type fittings applied with an appropriate hydraulic tool. Splices used only where approved. Splice fittings: Burndy "Hydent". Insulate splices with 600 volt, 105°C, "heat shrink", "cold shrink" covers, or taped insulation consisting of rubber, friction and vinyl tapes applied per manufacturer for 600 volt, 105°C covering to 150 percent of installation rating of conductor.
1. Acceptable Splice and Tape Manufacturers
    a) Burndy
    b) Thomas & Betts
    c) Ilsco
    d) Anderson
    e) Blackburn
    f) Oz/Gedney

D. Connectors and/or Terminations for Conductors #6 AWG and larger: Tin plated, 98% copper, dual crimp long barrel compression lugs with two bolt holes, insulated with molded covers to accommodate 1/2" bolts. Apply with hydraulic tool recommended by manufacturer.
1. Acceptable Manufacturers and Products
    a) O-Z Gedney
    b) Burndy Engineering Company "Hylugs"
    c) Thomas and Betts, "Color Keyed"
    d) Anderson

E. Use pulling lubricant which will not be detrimental to insulation of conductors indicated by published user information.
1. Acceptable Manufacturers of Lubricant
    a) Ideal Industries
    b) Panduit Corp.
    c) OZ/Gedney
    d) Plymouth/Bishop
    e) American Polywater Corp.
    f) Thomas & Betts

F. Insulate all live joints to 600 volts with strip rubber, friction tape, and electrical vinyl tape installed in accordance with manufacturers recommendations.
1. Acceptable Tape Manufacturers
    a) 3M
    b) Plymouth

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable under provisions of Section 260553. Identify each conductor with its circuit number or other designation indicated.

D. Install wiring complete with connections to equipment.

E. There may be cases where circuit or feeder conductor sizes are too large or too small to fit into the lugs normally supplied with the power distribution equipment or end-use equipment, due to circumstances such as increasing conductor sizes to offset voltage drop, unusual breaker frame sizes, type of conductors used, etc. In such cases provide appropriate factory lug kits for affected equipment if recommended by manufacturer; elsewhere provide insulated butt-splices with tails sized to fit respective lugs.

F. Install wiring so conductors are not in tension in completed system.

G. Form wiring neatly and group in circuit. Tie grouped conductors with nylon ties, T&B "Tyrap" or approved equivalent.

H. Each conduit run shall be run complete end to end before conductors are installed.

I. Use pulling lubricant to decrease pulling tension for all feeder cables, and all difficult cable pulls of any type or size. Pull all conductors into raceway at the same time.

J. Provide cable supports, at locations required by NEC and/or as shown. Supports with malleable screwed conduit fitting and non-conductive wedges drilled for the size conductors installed. Provide supports rated for all types of insulation and all voltage. Cable supports shall be O.Z./Gedney type "R" or accepted equivalent. Furnish pullbox, sized per NEC for each cable support.

K. Bond circuit ground wires where installed to all devices, equipment, outlet and junction boxes, and grounding bushings (where provided) with a full size conductor and lugged type connection.

L. Securely fasten non-ferrous identifying tapes, pressure sensitive labels or engraved nameplates to all cables, feeders and power cables exposed in vaults, inside pull boxes, exposed in manholes, exposed in switchboard, termination compartments, etc

M. Join and terminate copper conductors individually. Do not mix voltages in the same raceway.

N. Provide lugs where not furnished as part of equipment - furnish as specified above, to connect all conductors.

O. Furnish lugs for conductors #1/0 and larger with two bolt tongue or accepted equivalent single bolt tongue with anti-turn devices.

P. Mark all branch circuit conductors at panel terminations including neutrals with pressure sensitive numbers to correspond to circuit numbers connected. See Section 260553 for labels.

Q. Connect circuits and feeders as shown on drawings. Drawings are diagrammatic and do not show every detail required in the wiring system. Detail wiring accomplished per NEC.

R. All conductors making up parallel feeders to be same size, same type, and same insulation, all cut same length. Bond each group of conductors making up a phase or neutral at both ends in an approved manner. Parallel conductors shall not be run in the same raceway.

S. DO NOT COMBINE CIRCUITS into more than three circuits per homerun unless specifically approved by the Consultant.

T. Neutral conductors shall not be used for equipment grounding.

U. Circuitry shall not be run in elevator shafts and hoistways.

V. Provide a separate neutral and grounding conductor for all GFI circuits or GFI devices to ensure an adequate ground-fault return path.

W. Conductors for general purpose receptacle and all lighting circuits shall be installed in accordance with the following conditions:

1. Maximum one-way circuit length in feet for 90°C copper conductors with unity power factor to first device on circuit. Assumed 1920VA/120V and 4432VA/277V loading per circuit.

   a. 120V – Single Phase
      1) #12AWG – 53’
      2) #10AWG – 88’
      3) #8AWG – 138’
      4) #6 AWG – 223’

   b) 277V – Single Phase
      1) #12AWG – 123’
      2) #10AWG – 205’
      3) #8AWG – 319’
      4) #6AWG – 515’

X. Panelboards may not be used as raceways.

Y. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

Z. Install terminal lugs on ends of 600-volt wires unless lugs are furnished on connected device, such as circuit breakers.

AA. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

BB. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

CC. Clean conductor surfaces before installing lugs and connectors.

DD. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3.4 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
   2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

B. Related Sections:
1. Section 03 20 00 - Concrete Reinforcing: Bonding or welding bars when reinforcing steel is used for electrodes.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Metal underground water pipe.
2. Metal building frame.
3. Concrete-encased electrode.
4. Rod electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Installation Instructions: Submit for active electrodes.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. General Conditions: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

A. General Conditions: Requirements for coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

A. Product Description:
   1. Material: Copper-clad steel.
   2. Diameter: 3/4 inch (19 mm).
   3. Length: 10 feet (2.4 m).

B. Connector: Connector for exothermic welded connection.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: As shown on drawings.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare.

2.3 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches NPS (DN200) by 18 inches (600 mm) long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.4 MECHANICAL CONNECTORS

A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation. Where connection is made to domestic water with a bonding connector, contractor shall remove all paint/tape at connection point to adequately expose bare copper for a proper bonding connection.

2.5 EXOTHERMIC CONNECTIONS

A. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Verification of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system to maintain continuity to accommodate renovations.

B. Extend existing grounding system using materials and methods as specified.

3.4 INSTALLATION

A. Install in accordance with IEEE 142.

B. Install grounding and bonding conductors concealed from view.

C. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

D. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings. Electrically bond steel together.

E. Bond together metal siding not attached to grounded structure; bond to ground.

F. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

G. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

H. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

I. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

J. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

K. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.5 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground resistance testing in accordance with IEEE 142.

E. Perform continuity testing in accordance with IEEE 142.

F. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION 260526

SECTION 26 05 29 – HANGERS, SUPPORTS AND FIRESTOPPING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

1.2 REFERENCES

A. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479, to achieve fire ratings of adjacent construction. In accordance with Design Numbers.

B. Surface Burning: UL 723 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to UL for fire resistance ratings and surface burning characteristics.

1.6 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience approved by manufacturer.

1.9 PRE-INSTALLATION MEETINGS

A. General Conditions: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. General Conditions: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F (15 degrees C).

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 – PRODUCTS

2.1 CONDUIT SUPPORTS

A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

2.2 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage (2.8 mm) thick steel. With holes 1-1/2 inches (38 mm) on center.

2.3 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

A. Furnish materials in accordance with project standards.

B. Sleeves Through Non-fire Rated Floors: 18 gage (1.2 mm) thick galvanized steel.

C. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 mm thick galvanized steel.

D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

E. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Manufacturers:
1. Dow Corning Corp.
2. 3M fire Protection Products.
3. Specified Technology, Inc.
4. Substitutions: General Conditions

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.

5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: Dark gray.

2.7 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:
1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 – EXECUTION

3.1 EXAMINATION

A. General Conditions: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Obtain permission from Architect/Engineer before using powder-actuated anchors.

D. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide precast inserts, expansion anchors, and preset inserts.
2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

B. Inserts:
1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards
1 inch (25 mm) off wall.
4. Support vertical conduit at every floor.

G. Support EMT within twelve inches of each outlet, junction box, cabinet or fitting and every eight-foot thereafter. Combination box/conduit hangers are not allowed.
1. Acceptable Individual conduit hanger manufacturers
a. Appleton
b. Minerallac
c. OZ Mfr. Co.
d. Erico-Products
e. Steel City
f. Thomas & Betts

H. Support for multiple conduit runs shall consist of trapeze type hangers as required. Galvanized bolts or rods shall be 3/8” minimum diameter and anchored to structure. Provide support system clamp for each conduit on hangers. Support systems shall utilize 1-5/8” x 1-5/8” x 12 gage multi-purpose steel channels, complete with all necessary hardware, clamps, etc. all channel hardware shall be galvanized and/or plated to prevent corrosion. Channel sizes and quantity, and number of support rods shall be increased to support increased weights. Design each assembly to carry the combined weight of conduit and wire, assembly itself plus 100 pounds. Provide space for 25 percent additional conduit of the same size.

I. 1. Acceptable Manufacturers of channel support Systems
   a. B-Line
   b. Kindorf
   c. Superstrut
   d. Unistrut

I. All hangars for electrical items (conduit, boxes, fixtures and all other related equipment) where an "Epic Deck" system occurs shall be compatible for use with this system, "Epic Deck" is by Epic Metals Corporation. See Architectural and Structural drawings for locations. Do not install any conduit directly attached to any roof system, including the 'Epic Deck'.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

E. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
   2. Where cable tray, conduit, wireway, and cable penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

F. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition, floor, ceiling and roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
      c. Install type of firestopping material recommended by manufacturer.
   2. Install floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
   3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
   4. Interior partitions: Seal pipe penetrations at computer rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches (87 mm) thick and extending 4 inches (150 mm) beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install chrome plated steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. General Conditions: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.

B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system. Exposed junction/pull boxes are not acceptable in finished areas, pull/spare boxes shall be above ceilings and hidden from view. All pull boxes shall be accessible.

B. Underground: Provide schedule 40 PVC. Provide pre-cast concrete or nonmetallic handholes, vaults or manholes.

C. In or Under Slab on Grade: Under slab on grade provide PVC conduit. Minimum size ¾" conduit. Conduit not allowed to be run within slab on grade.

D. Outdoor Locations, Above Grade: Provide electrical metallic tubing. Where exposed to physical damage and heavy moisture (including roof tops) use rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.

E. In or Under Slab on Grade: Under slab on grade provide PVC conduit. Minimum size ¾" conduit. Do not group/bundle conduits under vapor barrier. Conduits under the building slab shall be dispersed in congested areas. Routing shall be reviewed by Structural Engineer prior to vapor barrier installation. Where conduits cross under the slab, they shall be separated by base/soil material acceptable to Structural Engineer. Conduit not allowed to be run within slab on grade.

F. Interior Wet Locations: Provide rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

G. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

H. Exposed Dry Locations: Provide electrical metallic tubing, except where exposed to physical damage; provide rigid steel conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes. Exposed conduit in finished areas not acceptable. Exposed conduit shall be kept to a minimum in all cases, and approved by the owner prior to rough-in or installation in areas where exposed conduit will be installed by the Contractor.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 1/2inch (13mm) unless otherwise specified. Comply with NEC for minimum size conduit and installation requirements. Minimum size 1/2 inch diameter for branch circuits, minimum size 3/4 inch diameter for homeruns. Minimum size for PVC conduit shall be 3/4 inch in diameter. Conduits shall be installed complete end-to-end prior to installing conductors.

1.5 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit for the following:
1. Flexible metal conduit.
2. Liquidtight flexible metal conduit.
3. Nonmetallic conduit.
4. Raceway fittings.
5. Conduit bodies.
6. Surface raceway.
7. Wireway.
8. Pull and junction boxes.
9. Handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents:
1. Record actual routing of conduits 2” and larger.
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Product storage and handling requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. General Conditions: Coordination and project conditions.

B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings and Conduit Bodies: NEMA FB 1; all steel fittings. Threadless fittings shall not be used.

D. Terminate rigid conduit in dry locations with two steel locknuts, one inside, one outside of the cabinet, junction box or outlet box and an insulated bushing. Bushings shall be malleable iron or steel with smooth insulating ring molded into edge of bushing to prevent damage to cable. Insulated bushings shall be 150 degree C self extinguishing thermoplastic. Provide grounding bushings on 1 ½ inch conduit and larger. Construction of bushings shall be similar to steel bushings described above except provide lugs for grounding connection.

E. Where conduits are installed underground, the threaded joints shall be sealed with a conductive joint sealing compound.

2.2 PVC COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil (0.05 mm) thick.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction.

B. Fittings: NEMA FB 1.

C. Connectors and fittings galvanized steel, threadless type with insulated throats, U.L. approved for grounding means.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC jacket.

B. Fittings: NEMA FB 1.

C. Fitting Assembly – Sealing type, with steel gland, nylon ring and ground cone inside locknut. All fittings with insulated throat, U.L. approved for grounding means.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; use insulated throat galvanized steel, rain tight, compression or set screw type. Compression type must be used in all medical facilities and in damp locations. Provide grounding bushing on 1¼ inch and larger. **Zinc alloy and similar soft metal castings are not allowed.**

2.6 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 PVC. Minimum sizes shall be 3/4 inch by diameter.

B. Fittings and Conduit Bodies: NEMA TC 3.

C. Fittings same material as conduit and installed with watertight joint compound recommended by manufacturer.

2.7 WIREWAY

A. Product Description: NEMA Type 1, General purpose, Oiltight and dust-tight. NEMA Type 3R, raintight type wireway as required to meet project conditions. Open top assembly.

B. Knockouts: NEMA Type 1, Manufacturer's standard. NEMA Type 3R – none.

C. Size: As indicated on Drawings.

D. Cover: NEMA Type 1 – removable hinged cover latches with captive screws. NEMA Type 3R – removable cover with quick release latches and full gaskets.

E. Connector: Slip-in.

F. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

G. Finish: Rust inhibiting primer coating with gray enamel finish.

2.8 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch (13 mm) male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Furnish gasketed cover by box manufacturer.

C. Wall Plates for Finished Areas: As specified in Section 26 27 26.

D. Wall Plates for Unfinished Areas: Galvanized industrial raised rings suitable for device type.

2.9 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 27 16.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. Flush pull boxes installed in walls shall have oversized covers and be painted to match surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION – RACEWAY

A. Electrical conduits shall be run concealed where building construction allows. Any exposed conduit shall be approved by the owner or architect prior to installation. Any exposed conduit, fittings, supports, etc shall be painted to match the surface on which they are installed.

B. Conduit within the roof deck assembly shall be installed in accordance with NEC 300.4(E) and (F). Utilize Galvanized Rigid Conduit (GRC), or Intermediate Metallic Conduit (IMC) with steel plates to protect junction boxes from roof insulation attachment anchors.

C. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

D. Arrange raceway supports to prevent misalignment during wiring installation.

E. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

F. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

G. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

H. Do not attach raceway to ceiling support wires or other piping systems.

I. Construct wireway supports from steel channel specified in Section 26 05 29.

J. Route exposed raceway parallel and perpendicular to walls.

K. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

L. Route conduit in and under slab from point-to-point.

M. Maintain clearance between raceway and piping for maintenance purposes.

N. Maintain 12 inch (300 mm) clearance between raceway and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

O. Cut conduit square using saw or pipe cutter; de-burr cut ends.

P. Bring conduit to shoulder of fittings; fasten securely.

Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

R. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

S. Install no more than equivalent of three 90 degree bends (270 degrees total) between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.

T. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

U. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

V. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

W. Surface Wireway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

X. Close ends and unused openings in wireway.

Y. Use rigid metal conduit or PVC coated rigid steel conduit on all through slab transitions. Use rigid metal conduit elbows 2-lap wrapped with 20mil 3M Scotch wrap or tape or PVC coated rigid steel conduit on all underground/underslab raceways 2 inches and larger.

Z. Exterior buried conduit shall be schedule 40 PVC with PVC coated RGS 90 degree bends.

AA. Use rigid steel conduit for all motor circuits where subject to physical damage.

BB. Intermediate grade metal conduit, (threaded only), may be used in lieu of rigid steel conduit where allowed by NEC.

CC. Use flexible steel conduit for:
1. Connection to vibrating equipment in dry locations between rigid conduit and connection box on equipment.
2. Final connections to equipment in dry locations.
3. Final connections to equipment requiring adjustments.

4. Final connections to recessed lighting fixtures from conduit system.
5. Connection to distribution transformers.
6. Maximum length 6'.

DD. Use Liquidtight flexible conduit in damp or wet locations for same circuit categories listed for flexible conduit above. Engineer will determine "damp or wet" locations if questionable.

EE. EMT shall not be installed underground and shall not be encased in concrete.

FF. Conduit must be installed high enough above lay in ceiling to permit removal of ceiling panels and light fixtures.

GG. In concrete slab on grade or elevated slabs: Conduit may penetrate slabs but will **NOT** be allowed to run in slabs on grade or elevated slabs.

HH. In accordance with NEC 300.4 conduit may not be run exposed across roof.

II. Due to the corrosive nature of the soil all metal conduit, couplings, elbows and fittings in contact with the soil or buried below grade shall be factory coated with PVC or two-lap wrapped with 20 mil 3M Scotchwrap with Pipe Primer applied as recommended by Manufacturer. Make underground conduit fittings watertight using conductive compound tape. Do not use split couplings and similar fittings underground and exposed to moisture.

JJ. Route underground conduits minimum 24" below grade.

KK. Paint conduit threads exposed to moisture with exterior grade, rust preventive silver paint after installation.

LL. Where conduit crosses expansion joints, install expansion type fittings with bonding jumper. Use expansion joint with lateral conduit movement of 4" or 8" as indicated. When both vertical and lateral movement is expected the joint shall be a 1" braided flexible coupling allowing both directional movements.

MM. Vibrating equipment and equipment requiring adjustment, i.e.: motors, transformers, etc: make final connections with flexible metal conduit.

NN. Isolate conduit connections to equipment on roof from roof penetration of conduit with short section of liquid-tight flexible conduit between roof penetration and equipment to prevent leak in roof penetration due to equipment vibration.

OO. Supports shall be installed in accordance with Seismic standards. Provide necessary side braces and swing joints as required. See Spec Section 26 05 30 Seismic Protection for Electrical Equipment.

PP. All conduit penetrations through or within CMU walls shall be rigid steel. Conduit run within CMU walls encased in concrete shall be PVC. All conduit penetrations (floors, walls, slab on grade, roofing) shall be made watertight with a joint sealant compound.

3.4 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches (150 mm) separation (non-rated or acoustically rated). Install with minimum 24 inches (600 mm) separation in fire-rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

P. Seal boxes during construction to prevent entrance of construction debris.

Q. Paint wiring connections in ground mounted outlets or floor outlets in wet locations with “Scotchkote” and fill box with “Duxseal”.

R. Refer to structural details regarding installation of boxes and conduit within CMU walls and adjacent to openings. All boxes and conduit must maintain minimum spacing requirements per structural details.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. General Conditions: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION 26 05 33

SECTION 26 05 53 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide and install required identification for the systems and equipment shown on the drawings and/or specified. The extent of identification is specified herein and in individual technical sections of work.

B. Coordinate with Consultant and Owner for proper equipment identification nomenclature. Nameplates must be approved by Consultant prior to ordering and installation.

C. Types of electrical identification include:
1. Conduit labeling.
2. Buried cable and conduit warnings.
3. Cable/conductor identification.
4. Operational instructions and warnings.
5. Danger signs.
6. Equipment/system identification labels and signs.
7. Device plate labeling.
8. Junction box labeling.

1.2 RELATED WORK

A. Painting of conduit and color-coded painting of conduit if required. See Division 9.

1.3 SUBMITTALS

A. Manufacturer's Data
1. Product specifications and installation instructions for each material and device.

B. Samples
1. Provide for each color, lettering style and other graphic representation.

C. Labels
1. Provide a list of labels with actual designations as they will be printed.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIAL

Conform to ANSI A13.1, Table 3 for minimum size of legend letters and minimum length of color field for each raceway or cable size. Use colors prescribed by ANSI A13.7, NFPA 70 and these specifications.

A. Color-Coded Conduit Markers
1. Manufacturer's standard preprinted, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360 degrees around conduits. Attach with adhesive, adhesive lap joint of marker, matching adhesive plastic tape at each end of marker, or pre-tensioned snap-on. Lettering to indicate voltage, function of conductors in conduit and shall be 8" minimum length (i.e. ac power, dc power, fire alarm).

B. Color-Coded Plastic Tape

1. Manufacturer's standard self-adhesive vinyl tape, minimum 3 mils thick by 1-1/2" wide.
2. Color: Orange.

C. Underground Plastic Line Marker
1. Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, for direct-burial service; minimum 4" wide x 4 mils thick. Printing to indicate type service of cable; with large (minimum 2-1/2") high letters.

D. Cable/Conductor Identification Bands
1. Manufacturer's standard vinyl self-adhesive self laminating cable/conductor markers, wrap-around type; pre-numbered plastic coated, or write-on type with clear plastic self-adhesive cover flap, lettered to show circuit identification. Similar to Panduit "Instacode" or accepted equivalent by T&B, or Tyton. Refer to Section 26 05 19 Low Voltage Electrical Power Conductors and Cables.

E. Self-Adhesive Plastic Signs
1. Manufacturer's standard, self-adhesive, pre-printed, flexible vinyl signs for operational instructions or warnings. Sizes suitable for application and visibility, with proper wording for application.
2. Color: Orange or Yellow with black lettering.

F. Danger Signs
1. Manufacturer's standard "DANGER" signs, baked enamel finish on 20 gage steel; standard red, black and white graphics; 14" x 10" unless 10" x 7" is largest which can be applied, or where larger size is needed for visibility use recognized explanation wording (as examples: HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH, DANGER-STARTS AUTOMATICALLY).

G. Engraved Signs (Nameplates)
1. Use 1/8" thick melamine plastic laminate, complying with FS LP-387, sizes as indicated, engrave with standard letter style of sizes and wording indicated (1/4" letters minimum).
2. Color: Black field with white letters for normal power service;
3. Fasteners: Self adhesive backing or double stick tape.

H. Permanent Polyester Tape:
1. Use Permanent Metalized Polyester Tapes for Industrial purposes that are resistant to oil, solvents and chemicals, these durable tapes adhere to all surface.
2. DYMO #18485, Black on Silver, 3/8” wide, or equivalent.

I. Lettering and Graphics
1. Coordinate names, abbreviations and other designations used with those shown or specified. Provide numbers, lettering, and wording as indicated or required for identification and operation/maintenance.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements
1. Install after completion of painting.
2. Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification

1 Use adhesive marking tape labels, Brother or Kroy labels 1" high x 12" long (min.), at 20 foot intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible. Labels for multiple conduits shall be aligned. Use the following colors:
   a. Above 600 Volts: Conduit 2” and larger - Black letters on orange background indicating feeder identification and voltage. Feeders within walls: provide identification on wall surfaces directly external to the conduits. Alternate identification labels with "DANGER - HIGH VOLTAGE" warning signs of the same color.
   b. 600 Volt and Below Normal: Conduit 2” and larger - White letters on black background indicating feeder identification and voltage. Not required unless otherwise noted.
   c. 600 Volt and Below Emergency: All conduit - White or black letters on red background indicating feeder identification and voltage. Not required unless otherwise noted
   d. 600 Volt and Below UPS: All conduit - Black letters on yellow background indicating feeder identifications, circuit number and voltage. Not required unless otherwise noted
   e. Fire Alarm: All conduit shall be manufactured red.
   f. Temperature Control: White or black letters on blue background indicating "TEMP. CONTROL"
   g. Ground: All conduit - White or black letters on green background
   h. Network Fiber: All conduit - Black letters on white background indicating "NETWORK FIBER."
2. Where conduits enter or exit a panelboard, pull or junction box, switchboard, or other distribution equipment, conduit labels shall include circuit number in addition to feeder identification and voltage.
3. For overhead conduits, place identification such that it can be read standing on the floor below.

C. Underground Cable Identification
1. During back-filling of underground cable, install continuous underground marker, directly over buried line 6" to 8" below finished grade. Where multiple lines are buried in common trench not exceeding 24" width, install a single line marker. Install additional line markers for each increment of 24” width, i.e., 36” wide trench - 2 markers; 54” wide trench, 3 markers. Install multiple markers evenly spaced.
2. Install line marker for every buried ductbank and/or conduits 3" diameter or larger.
3. Electric Lines: Use red colored tape with lettering stating “CAUTION BURIED ELECTRIC LINE BELOW”.
4. Communication Lines: Use orange colored tape with lettering stating “CAUTION COMMUNICATION LINE BELOW”.

D. Operational Identification and Warnings
1. Provide operational signs for:
   a. Switchgear
   b. Large motor starters
   c. All rotating equipment

E. Danger Signs
1. Provide as required by codes.

F. Engraved Plastic Laminated Signs
1. Install on each major unit of electrical equipment in the building. Provide single line of text, 1/4" high lettering on 1" high sign (1-1/2" high where 2 lines required). Matching terminology and numbering as indicated in contract documents.

2. Provide signs for each unit of the following categories:
   a. Electrical cabinets and enclosures: Indicate cabinet designation, voltage, phase and feeder origin.
   b. Access panel/doors to electrical facilities: Indicate room name and use.
   c. Major electrical switchgear: Indicate equipment designation, voltage, phase and feeder origin.
   d. Electrical substations: Indicate equipment designation, voltage, phase and feeder origin.
   e. Safety switches, circuit breakers and portable engine disconnects: Indicate equipment designation, voltage, phase, feeder origin and circuit number.
   f. Transformers: Indicate transformer designation, voltages, phases, feeder origin, circuit number and equipment served.
   g. Feeder cables inside pull and junction boxes and inside all switchgear at terminals indicating source and destination: Fasten with nylon ties.
   h. All equipment furnished in this Division of the specifications: Indicate equipment designation, voltage, phase, feeder origin and circuit number.

G. Install signs where indicated or most visible. Secure with at least two cadmium-plated screws. Where substrate cannot receive screws, use industrial epoxy cement to secure signs. Self-adhesive or double stick tape is acceptable. Secure with cadmium plated screws on porous surfaces.

H. Identify all conduits installed for future use.

I. Junction, Pull and Connection boxes. Identification of systems and circuits shall indicate system voltage and identity of contained circuits on outside of box cover. Color code shall be same as conduits for pressure sensitive labels. Use self-adhesive marking tape labels at exposed locations and indelible black marker at concealed boxes. All fire alarm boxes shall have red covers. All temperature control boxes shall have blue covers.

J. Branch Circuit Conductors shall be identified in each junction box and pull box with wire markers as manufactured by T & B, Panduit, 3M or Ideal to indicate panel/circuit number.

K. Junction Boxes in branch circuit wiring shall be labeled with panel and circuit numbers. Junction boxes for special systems shall be labeled with system name and other identification as directed; for example, “fire alarm-zone 1”. Where boxes are installed flush mounted in finished areas or surface mounted in unfinished areas, labeling shall be with engraved plastic nameplate as specified herein. Where boxes are installed above accessible ceilings, labeling may be neat hand written lettering with indelible marker.

L. Device Plates – switches and receptacles. Identify the panelboard and branch circuit number from which served on the front of the device plate with Permanent Polyester Clear Tape with black letters. Locate all labels at the bottom of the plate in the same location throughout.

END OF SECTION 26 05 53

SECTION 26 05 73.13 - SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Computer-based, fault-current study to determine minimum interrupting capacity of circuit protective devices.

B. Related Requirements:

1. Section 26 05 73.16 "Coordination Studies" for overcurrent protective device coordination studies.
2. Section 26 05 73.19 "Arc-Flash Hazard Analysis" for arc-flash studies.

1.2 STUDY SCOPE

1. Study shall encompass all portions of electrical distribution system from normal power source and/or standby sources up to and including breakers in service entrance switchboard, main breaker in sub-distribution panels, main breaker in each panelboard, etc.
2. For existing systems, the scope of the study must include the point where modifications are made and all upstream branches of the distribution system back to the service entrance utility point of connection, even if not being modified by this project.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items must remain functional throughout construction period.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

F. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. For power system analysis software to be used for studies.

B. Short-Circuit Study Report:

1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form.

a. Short-circuit study input data, including completed computer program input data sheets.
b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Engineer for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
c. Revised one-line diagram, reflecting field investigation results and results of short-circuit study or updates required based on data collected for the study.
d. Study report shall include documentation of all equipment data used in the short-circuit and equipment duty analysis.
e. Study shall include a detailed listing of any electrical equipment found to be underrated for the calculated fault duty.

C. Closeout Submittals:

1. Provide one (1) hard copy of the oneline diagram in a tube to be magnetically attached to the side of the service entrance.

2. Provide two (2) digital (CD or USB) copies of the study model in the native format for which it was created (SKM, EasyPower, ETAP). One shall be magnetically attached to the side of the service entrance and the other shall be given to the Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Product Data:

1. Submit information on computer software program to be used for studies.

2. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

B. Qualification Data:

1. For Power Systems Analysis Software.
2. For Power System Analysis Specialist.
3. For Power System Field Adjusting Agency.

1.6 CLOSEOUT SUBMITTALS

A. Final Report:
1. Final one-line diagram

2. Final short-circuit study report
3. Short-circuit data files

1.7 QUALITY ASSURANCE

A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms must comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.
1. Power System Analysis Software Qualifications: Computer program shall be designed to perform ANSI and IEC based short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.

D. Power Systems Analysis Specialist Qualifications: Professional Engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this Professional Engineer.

E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed by Power Systems Analysis Specialist.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE

A. Comply with IEEE 399 and IEEE 551.

B. Analytical features of power systems analysis software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program must be capable of plotting and diagramming time-current-characteristic curves as part of its output.

D. Computer program must be designed to perform short-circuit studies or have function, component, or add-on module designed to perform short-circuit studies.

E. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

F. Manufacturers:
1. SKM Systems Analysis, Inc.
2. EasyPower, LLC
3. ETAP

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kVA and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. Derating factors and environmental conditions.
7. Any revisions to electrical equipment required by study.

D. Comments and recommendations for system improvements or revisions in written document, separate from one-line diagram.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600 V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data:

1. One-line diagram of system being studied.
2. Power sources available.
3. Manufacturer, model, and interrupting rating of protective devices.
4. Conductors.
5. Transformer data.

G. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.

c. Fault-point X/R ratio.
d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain data necessary for conduct of study.

1. Verify completeness of data supplied on one-line diagram. Call discrepancies to Engineer’s attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers in accordance with NFPA 70E.

B. Gather and tabulate required input data to support short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to amount of detail that is required to be acquired in field. Field data gathering must be under direct supervision of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.

6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

3.2 SHORT-CIRCUIT STUDY

A. Perform study following general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Begin short-circuit current analysis at service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment supplied by single transformer smaller than 75 kVA.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. Include ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

G. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.

H. Include in report identification of protective device applied outside its capacity.

END OF SECTION 26 05 73.13

SECTION 26 05 73.19 - ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Computer-based, arc-flash study to determine arc-flash hazard distance and incident energy to which personnel could be exposed during work on or near electrical equipment.

B. Related Requirements:

1. Section 260573.13 "Short-Circuit Studies" for fault-current studies.
2. Section 260573.16 "Coordination Studies" for overcurrent protective device coordination studies.

1.2 STUDY SCOPE

1. Study shall encompass all portions of electrical distribution system from normal power source and/or standby sources up to and including breakers in service entrance switchboard, main breaker in sub-distribution panels, main breaker in each panelboard, etc.
2. For existing systems, the scope of the study must include the point where modifications are made and all upstream branches of the distribution system back to the service entrance utility point of connection, even if not being modified by this project.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. p.u.: Per unit. The reference unit, established as a calculating convenience, for expressing all power system electrical parameters on a common reference base.

E. SCCR: Short-circuit current rating.

F. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

G. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. For power system analysis software to be used for studies.

B. Study Submittals:

1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form:

a. Arc-flash study input data, including completed computer program input data sheets.
b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
c. Revised one-line diagram, reflecting field investigation results and results of arc-flash study.

C. Closeout Submittals:

1. Provide one (1) hard copy of the oneline diagram in a tube to be magnetically attached to the side of the service entrance.

2. Provide two (2) digital (CD or USB) copies of the study model in the native format for which it was created (SKM, EasyPower, ETAP). One shall be magnetically attached to the side of the service entrance and the other shall be given to the Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 QUALITY ASSURANCE

A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms must comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Comply with IEEE 1584 and NFPA 70E.

B. Analytical features of device coordination study computer software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer program must be designed to perform arc-flash analysis or have function, component, or add-on module designed to perform arc-flash analysis.

D. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Manufacturers:
1. SKM Systems Analysis, Inc.
2. EasyPower, LLC
3. ETAP

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kVA and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

G. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in report:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce 3.5 by 5 inch (76 by 127 mm) self-adhesive equipment label for each work location included in analysis.

B. Label must have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.
    a. Arc-flash boundary.
    b. Restricted approach boundary.
    c. Limited approach boundary.
4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels must be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies: Perform Short-Circuit and Protective Device Coordination study studies prior to starting Arc-Flash Hazard Analysis.

1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation must assume maximum contribution from utility and must assume motors to be operating under full-load conditions.
2. Calculate arc-flash energy at 85 percent of maximum short-circuit current in accordance with IEEE 1584 recommendations.
3. Calculate arc-flash energy with utility contribution at minimum and assume no motor contribution.

D. Calculate arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment fed from transformers smaller than 75 kVA.

F. Calculate limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must take into account changing current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:

1. Fault contribution from induction motors must not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).

H. Arc-flash energy must generally be reported for maximum of line or load side of circuit breaker. However, arc-flash computation must be performed and reported for both line and load side of circuit breaker as follows:

1. When circuit breaker is in separate enclosure.
2. When line terminals of circuit breaker are separate from work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain data necessary for conduct of arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.

2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

A. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to amount of detail that is required to be acquired in field. Field data gathering must be under direct supervision of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

B. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
1. Obtain electrical power utility impedance or available short circuit current at service.
2. Power sources and ties.
3. Short-circuit current at each system bus (three phase and line to ground).
4. Full-load current of loads.
5. Voltage level at each bus.
6. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
7. For reactors, provide manufacturer and model designation, voltage rating and impedance.
8. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
9. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
10. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
11. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
12. Motor horsepower and NEMA MG 1 code letter designation.
13. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
14. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.4 LABELING

A. Apply one arc-flash label on front cover of each section of equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below not fed by single transformer smaller than 75 kVA must have arc-flash label applied to it:

1. Low-voltage switchgear.
2. Switchboards.
3. Panelboards.
4. Motor-control centers.
5. Low voltage transformers.

6. Safety switches.
7. Control panels.

C. Note on record Drawings location of equipment where personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under direct supervision and control of qualified electrical professional engineer.

END OF SECTION 26 05 73.19

SECTION 26 09 23 – LIGHTING CONTROL DEVICES AND DLM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Distributed Digital Lighting Control System: System includes
   1. Digital Lighting and Plug Load Controls
   2. Relay Panels
   3. Emergency Lighting Control.

1.2 RELATED SECTIONS

A. Section 26 51 00 - Lighting.

B. Section 26 56 00 - Exterior Lighting.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

B. NEMA - National Electrical Manufacturers Association

C. FCC emission standards

D. UL - Underwriters Laboratories, Inc. Listings

E. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.

F. UL 20 - General Use Switches, Plug Load Controls

G. UL 924 - Standard for Emergency Lighting and Power Equipment

H. ULC - Underwriter Laboratories of Canada Listings

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.

B. System shall conform to requirements of NFPA 70.

C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

D. System shall be listed under UL sections 916 and/or 508.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Catalog sheets and specifications.
   2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service

condition requirements, and installed features.
3. Storage and handling requirements and recommendations.
4. Installation instructions.
5. Provide physical sample of switches demonstrating faceplate engraving as indicated on plans, as requested.

C. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:
1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
2. Operation and Maintenance Manual:
a. Include approved Shop Drawings and Product Data.
b. Include Sequence of Operation, identifying operation for each room or space.
c. Include manufacturer's maintenance information.
d. Operation and Maintenance Data: Include detailed information on device programming and setup.
e. Include startup and test reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:
1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
2. Review the specifications for low voltage control wiring and termination.
3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:

1. Record minutes of the conference and provide copies to all parties present.
2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
   2. Relative humidity: Maximum 90 percent, non-condensing.

1.10 WARRANTY

A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

1.11 REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS

A. Provide Manufacturer's Remote Access and Enhanced Warranty for Networked Lighting Controls as follows:
   1. Configure to allow the manufacturer remote access to the lighting control system. Configuration includes at a minimum: cellular modem, antenna for the modem, cellular service contract and any connections required to enable communication to the specified Network Lighting Control system.
   2. The Remote Access program will automatically trigger a First Year Enhanced Warranty Agreement that will start once lighting control system startup is complete and accepted by the Owner. During this one year period, the Owners authorized site contact can request the manufacturer to check the system for proper operation, and make any programmable changes desired. Manufacturer shall provide a phone number dedicated to customer calls concerning Remote Accessible systems, and a support organization capable of enabling cellular communication to the system for troubleshooting and making requested changes to the system. Any user attempting to request remote support on the system shall be fully verified by the Remote Operations Center (ROC) before providing remote support or making any changes to the system. Systems that allow the modem to be always accessible will not be acceptable. Access must be by a secured VPN connection to the private lighting control network that is completely isolated from the Owner's internal network. Remote access that requires a connection through the Owner's internal network is not acceptable.
   3. The Remote Access Program may be continued by the Owner after the first year. However, If the Owner does not continue the enhanced warranty the cellular contract will lapse, and all hardware components, while still remaining property of the manufacturer, will remain in situ so that they can be re-activated at a later time should the Owner desire.
   4. The Manufacturer's Remote Access capability shall provide at a minimum the following features:
      a. Ability to provide initial system diagnostics through LMCS Software to detect fault conditions in hardware or connected devices.

b. Access to all devices via LMCS Software allowing for programmability of device features. This will include all scheduling of Time of Day Events and programming of individual device parameters to meet Sequence of Operation requirements.
c. Access to the LMSM Segment Manager browser-based interface (if included on project) to verify it is setup per project documentation, and all functional operations are working properly.
d. On demand access to manufacturer technical support via a Remote Operations Center (ROC) that will provide remote troubleshooting, diagnostics, and configuration/programming assistance.
e. Additional client training and tuning on the Lighting Control System after building occupancy can be performed while remotely connected to the site.

5. Contractor shall coordinate networking/IT/VPN requirements with owner prior to start of system installation. The contractor is required to provide information from the lighting controls supplier as to the individual who is responsible for system startup. Coordinate with WCSD IT department for network access requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: WattStopper, which is located at: 2700 Zanker Rd., Suite 168; San Jose, CA 95134; Tel: 408.988.5331; Fax: 408.988.5373; Web:www.wattstopper.com

B. Substitutions: Acuity, Lutron.

C. With provisions of project general conditions for substitutions.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide a WattStopper, Provide Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.

1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in sequence of operations.
2. Provide additional sensors as required for a complete detection system in the associated space. Detectors shall be located clear of HVAC systems that may generate noise or vibration that would provide false readings in a space. The contractor is responsible for selecting the proper detection device for each space to provide optimal coverage and minimal nuisance to the user. In all cases the manufacturers direction regarding best possible placement shall be followed for optimal detection in each space located, shown or not.
3. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
   a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
   b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
   c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
   d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior

to dimming.

4. Conference, meeting, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
   1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
   2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
   3. Digital Plug Load Controllers: Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
   4. Digital Fixture Controllers: Self-configuring, digitally addressable one relay fixture-integrated controllers for on/off/0-10V dimming control.
   5. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
   6. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
   7. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
   8. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
   9. Digital Lighting Management (DLM) segment network: Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.
   10. Network Bridge: Provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
   11. Segment Manager: BACnet MS/TP-based controller with web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
   12. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
   13. Digital Lighting Management Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.
   14. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

1. Features of the DLM local network include:
   a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
   b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
   c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
   d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 DIGITAL LOAD CONTROLLERS (ROOM, FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features
   1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
   2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
   3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
   4. Device Status LEDs to indicate:
      a. Data transmission
      b. Device has power
      c. Status for each load
      d. Configuration status
   5. Quick installation features including:
      a. Standard junction box mounting
      b. Quick low voltage connections using standard RJ-45 patch cable
   6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
      a. Turn on to 100 percent
      b. Turn off
      c. Turn on to last level
   7. Each load be configurable to operate in the following sequences based on occupancy:
      a. Auto-on/Auto-off (Follow on and off)
      b. Manual-on/Auto-off (Follow off only)
   8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
   9. BACnet object information shall be available for the following objects:

a. Load status
b. Schedule state, normal or after-hours
c. Demand Response enable and disable
d. Room occupancy status
e. Total room lighting and plug loads watts
f. Electrical current
g. Total watts per controller
h. Total room watts/sq ft.
i. Force on/off all loads

10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
    a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
    b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
    c. The following dimming attributes may be changed or selected using a wireless configuration tool:
        1) Establish preset level for each load from 0-100 percent
        2) Set high and low trim for each load
        3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
    d. Override button for each load provides the following functions:
        1) Press and release for on/off control
        2) Press and hold for dimming control
    e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
    f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
    g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
    h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. On/Off Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
2. One or two relay configuration
3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
5. WattStopper product numbers: LMRC-101, LMRC-102

C. On/Off/0-10V Dimming KO Mount Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A total load
2. Optional real time current and voltage monitoring (with - M Monitoring option).
3. One or two relays configurations
4. Smart 150 mA switching power supply

5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
6. One dimming output per relay
    a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting
7. Units capable of providing both Class 1 or Class 2 wiring for the 0-10V output
8. WattStopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M.

D. On/Off/0-10V Dimming Enhanced Room Controllers shall include:
1. Dual voltage 120/277 VAC, 60 Hz capable. 120/277 volt models rated for 20A total load.
2. Built in real time current monitoring.
3. One, two or three relays configurations.
4. Smart 250 mA switching power supply.
5. Four RJ-45 DLM local network ports. Provide integral strain relief.
6. One dimming output per relay
    a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting (LMRC-110 series and 210 series).
7. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213.

E. On/Off/ Forward Phase Dimming Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) rated for 20A total load, with forward phase dimmed loads derating to 16A for some load types
2. Built in real time current monitoring
3. One or two relays configurations
4. Smart 250 mA switching power supply
5. Four RJ-45 DLM local network ports. Provide integral strain relief
6. One dimming output per relay
    a. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-220 series)
7. WattStopper product numbers: LMRC-221, LMRC-222

F. Fixture Controllers shall include
1. A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.
2. One 3A 120/277V rated mechanically held relay.
3. Programmable behavior on power up following the loss of normal power:
    a. Turn on to 100 percent
    b. Turn off
    c. Turn on to last level
4. Requirement for 7 mA of 24VDC operating power from the DLM local network.
5. Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the DLM local network to drive accessory devices.
6. Power to drive the LMFC Fixture Controller electronics can come from any Room or Plug Load Controller, LMPB-100 Power Booster and/or LMZC-301 Zone Controller (described later in the LMCP LIGHTING CONTROL PANELS specification section).
7. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.

8. Connect to a single or dual RJ-45 adaptor with 24 inch leads. Single adaptor mounts in a 1/2 inch KO and dual adaptor in a 2.2 by 1.32 inch rectangular hole for connection to the DLM local network.
9. Adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.
10. A complete set of dimming features described above in the paragraph detailing On/Off/Dimming Enhanced Room Controllers.
    a. WattStopper product numbers: Fixture Controller: LMFC-011, DLM Cable Connector: LMFC-RJ-50-24 or LMFC-2RJ, Power Booster: LMPB-100.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
    1. Digital calibration and pushbutton configuration for the following variables:
        a. Sensitivity, 0-100 percent in 10 percent increments
        b. Time delay, 1-30 minutes in 1 minute increments
        c. Test mode, Five second time delay
        d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
        e. Walk-through mode
    2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
    3. Programmable control functionality including:
        a. Each sensor may be programmed to control specific loads within a local network.
        b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
        c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
        d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
        e. Ultrasonic and Passive Infrared
        f. Ultrasonic or Passive Infrared
        g. Ultrasonic only
        h. Passive Infrared only
        i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
    4. One or two RJ-45 port(s) for connection to DLM local network.
    5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
    6. Device Status LEDs, which may be disabled for selected applications, including:
        a. PIR detection
        b. Ultrasonic detection
        c. Configuration mode
        d. Load binding
    7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
    8. Manual override of controlled loads.
    9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:

1. Detection state
2. Occupancy sensor time delay
3. Occupancy sensor sensitivity, PIR and Ultrasonic

C. Units shall not have any dip switches or potentiometers for field settings

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.5 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton configuration for the following variables:
      a. Sensitivity: 0-100 percent in 10 percent increments
      b. Time delay: 1-30 minutes in 1 minute increments
      c. Test mode: Five second time delay
      d. Detection technology: PIR, Dual Technology activation and/or re-activation.
      e. Walk-through mode
      f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   2. Programmable control functionality including:
      a. Each sensor may be programmed to control specific loads within a local network.
      b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
      c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
      d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
         1) Ultrasonic and Passive Infrared
         2) Ultrasonic or Passive Infrared
         3) Ultrasonic only
         4) Passive Infrared only
   3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
   4. Two RJ-45 ports for connection to DLM local network.
   5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
   6. Device Status LEDs including
      a. PIR detection
      b. Ultrasonic detection
      c. Configuration mode
      d. Load binding
   7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
   8. Assignment of local buttons to specific loads within the room without wiring or special tools
   9. Manual override of controlled loads
   10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Detection state
   2. Occupancy sensor time delay
   3. Occupancy sensor sensitivity, PIR and Ultrasonic
   4. Button state
   5. Switch lock control
   6. Switch lock status

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
   1. Left button
      a. Press and release - Turn load on
      b. Press and hold - Raise dimming load
   2. Right button
      a. Press and release - Turn load off
      b. Press and hold - Lower dimming load

F. Low voltage momentary pushbuttons shall include the following features:
   1. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
   2. The following button attributes may be changed or selected using a wireless configuration tool:
      a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
      b. Individual button function may be configured to Toggle, On only or Off only.
      c. Individual scenes may be locked to prevent unauthorized change.
      d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
      e. Ramp rate may be adjusted for each dimmer switch.
      f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
      g. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.6 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4 button configurations as shown on plan documents. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall. **All faceplates shall be provided with samples for review prior to installation**. All faceplates must be installed and complete prior to punch list.
   3. Configuration LED on each switch that blinks to indicate data transmission.
   4. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
      d. Dimming paddle switches shall include seven bi-level LEDs to indicate load

levels using 14 steps.

5. Programmable control functionality including:
   a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
   b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Button state
   2. Switch lock control
   3. Switch lock status

C. Two RJ-45 ports for connection to DLM local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
   1. Individual button function may be configured to Toggle, On only or Off only.
   2. Individual scenes may be locked to prevent unauthorized change.
   3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   4. Ramp rate may be adjusted for each dimmer switch.
   5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
   6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.7 DIGITAL DAYLIGHTING SENSORS

A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
   1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
   2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
   3. Dual loop sensors measure both ambient and incoming daylight in the space to ensure that proper light levels are maintained as changes to reflective materials are made in a single zone

B. Digital daylighting sensors shall include the following features:
   1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
   2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
   3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).

4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
    a. Light level
    b. Day and night setpoints
    c. Off time delay
    d. On and off setpoints
    e. Up to three zone setpoints
    f. Operating mode - on/off, bi-level, tri-level or dimming
14. One RJ-45 port for connection to DLM local network.
15. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
16. Any load or group of loads in the room can be assigned to a daylighting zone
17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Closed loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
4. WattStopper Product Number: LMLS-400, LMLS-400-L.

D. Open loop digital photosensors shall include the following additional features:

1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
4. WattStopper Product Number: LMLS-500, LMLS-500-L.

E. Dual loop digital photosensors shall include the following additional features:
1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
6. Device must include extendable mounting arm to properly position sensor within a skylight well.
7. WattStopper product number LMLS-600

2.8 DLM SEGMENT NETWORK

A. Provide a segment network using linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.
1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
3. Segment network utilizes 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
4. Network wire jacket is available in high visibility green, white, or black.
5. Substitution of manufacturer-supplied cable is not permitted and may void the warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
6. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
7. Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER or LMSM Unit. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable

B. WattStopper Product Number: LM-MSTP, LM-MSTP-W, LM-MSTP-B, LM-MSTP-DB

2.9 NETWORK BRIDGE

A. Network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. Network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
   1. Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
   2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
   3. Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
      a. Read/write the normal or after hours schedule state for the room
      b. Read the detection state of each occupancy sensor
      c. Read the aggregate occupancy state of the room
      d. Read/write the On/Off state of loads
      e. Read/write the dimmed light level of loads
      f. Read the button states of switches
      g. Read total current in amps, and total power in watts through the load controller
      h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
      i. Activate a preset scene for the room
      j. Read/write daylight sensor fade time and day and night setpoints
      k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
      l. Set daylight sensor operating mode
      m. Read/write wall switch lock status
      n. Read watts per square foot for the entire controlled room
      o. Write maximum light level per load for demand response mode
      p. Read/write activation of demand response mode for the room
      q. Activate/restore demand response mode for the room

B. WattStopper product numbers: LMBC-300

2.10 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:
   1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
   2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
   3. Interior assembly shall be supplied as a factory assembled component specifically

designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:

a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
b. Individual terminal block, override pushbutton, and LED status light for each relay.
c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
   a. Electrical:
      1) 30 amp ballast at 277V
      2) 20 amp ballast at 347V
      3) 20amp tungsten at 120V
      4) 30 amp resistive at 347V
      5) 1.5 HP motor at 120V
      6) 14,000 amp short circuit current rating (SCCR) at 347V
      7) Relays shall be specifically UL 20 listed for control of plug-loads
   b. Mechanical:
      1) Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.
      2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
      3) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
      4) Tested to 300,000 mechanical on/off cycles.
5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the

requirements of UL924 and NFPA 70 - Article 700.

8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
   a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 tnetworked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
   b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
   c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
   d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
      1) Scheduled ON / OFF
      2) Manual ON / Scheduled OFF
      3) Astro ON / OFF (or Photo ON / OFF)
      4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
   e. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
   f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
   g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
    a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
    b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
    c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
    d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
    e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
    f. Setup and commissioning of panel shall not require manufacturer-specific

software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:

1) Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
2) Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
3) Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
4) Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.

g. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
h. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)
i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
    a. Use the same intelligence board as the LMCP relay panel.
    b. Shall not include relay driver boards or relays.
    c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
    d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
    e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.
12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.
13. WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.

B. User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
    1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.

2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. WattStopper Product Number: LMCT-100

2.11 SEGMENT MANAGER

A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).

B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external BACnet-to-IP interface routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the Drawings.

C. Operational features of the Segment Manager shall include the following:
1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. The Segment Manager shall not require installation of any lighting control software on an end-user PC.
3. Log in security capable of restricting some users to view-only or other limited operations.
4. Segment Manager shall provide two main sets of interface screens - those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system, and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:
    a. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
    b. Allow information for all discovered DLM devices to be imported into the Segment Manager via a single XML based site file from the WattStopper LMCS Software, significantly reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location

information and overall structure of DLM network. Info entered into LMCS should not have to be re-entered manually via keystrokes into the Segment Manager

c. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.

d. Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.

e. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance.

5. Capabilities using the Segment Manager's Dashboard Screens shall include:

a. A dynamic "tile" based interface that allows easy viewing of each individual room's lighting and plug load power consumption, and lighting and plug load power density (power consumption information requires Enhanced DLM Room and Plug Load Controllers with integral current transducers such as LMRC-21x).Tiles will be automatically organized according to location so a single tile for the building summarizes all information for tiles beneath it on every floor, in every area, in every room. Tiles use three color coded energy target parameters, allowing an owner to quickly identify rooms that are not performing efficiently. Tiles for rooms with occupancy sensors shall include an icon to indicate whether that room is occupied. Tiles shall be clickable, and when clicked the underlying hierarchical level of tiles shall become visible. Tile interface shall be accessible via mouse, or touch screen devices. Tiles shall be created automatically by the segment manager, based on the information found during the device discovery and/or information included in a file imported in from LMCS (such as tagged descriptions for each room) without any custom programming.

b. Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms with either on/off or normal hours/after hours set controlled zones or areas to either a normal hours or after hours mode of operation. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as astro On or astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week or month.

c. For fixtures that are accessible via the Segment Network, and have CCT capability as specified under paragraph Digital Wall Switch and Timer For Correlated Color Temperature, the Segment Manager will provide schedule functionality similar to the CCT Wall Timer, allowing all CCT fixtures across the entire facility to be scheduled together.

d. Ability to provide a simple time vs. power graph based on information stored in each Segment Manager's memory (typically two to three days' data).

6. Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

D. Segment Manager v2.2 and later shall support multiple DLM rooms as follows:

1. Support up to 120 network bridges and 750 digital in-room devices (LMSM-3E).
2. Support up to 200 network bridges and 1,100 digital in room devices, connected via network routers and switches (LMSM-6E).

E. WattStopper Product Numbers: LMSM-3E, LMSM-6E, LM-SUPERVISOR, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.12 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

B. Additional parameters exposed through this method include but are not limited to:
1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6. Load control polarity reversal so that on events turn loads off and vice versa.
7. Per-load DR (demand response) shed level in units of percent.
8. Load output pulse mode in increments of 1second.
9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
1. Device list report: All devices in a project listed by type.
2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.

D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
1. Set, copy/paste an entire project site of sensor time delays.

2. Set, copy/paste an entire project site of sensor sensitivity settings.
3. Search based on room name and text labels.
4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
5. Filter by parameter value to search for product with specific configurations.

E. Network-wide firmware upgrading remotely via the BACnet/IP network.
1. Mass firmware update of entire rooms.
2. Mass firmware update of specifically selected rooms or areas.
3. Mass firmware upgrade of specific products

F. WattStopper Product Number: LMCS-100, LMCI-100

2.13 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 EXECUTION

3.1 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.2 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.
3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
4. Low voltage wiring topology must comply with manufacturer's specifications.
5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

C. All line voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

L. Remote Access for Network Systems: If "REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS" is specified in Part 1 of this specification, ensure Segment Manager enclosure is installed in a location with good to excellent cellular phone coverage based on building orientation and geographic location, and mount magnetic antenna for the modem. For cases where alternate mounting locations are not available and a stronger cellular signal is needed, the manufacturer shall offer additional antenna options to improve signal quality. Verify final mounting location with Engineer and Owner prior to proceeding with the Work.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
   1. Verify Class I and II wiring connections are terminated properly by validating system performance.
   2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
   3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
   4. Verify that the control of each space complies with the Sequence of Operation.
   5. Correct any system issues and retest..

C. Provide a report in table format with drawings, or using a software file that can be opened in

the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
1. Date of test or inspection.
2. Loads per space, or Fixture Address identification.
3. Quantity and Type of each device installed
4. Reports providing each device's settings.

3.4 DEMONSTRATION AND TRAINING

A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
1. Confirmation of entire system operation and communication to each device.
2. Confirmation of operation of individual relays, switches, and sensors.
3. Confirmation of system Programming, photocell settings, override settings, etc.
4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.5 GENERAL PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

3.6 SUPPORT SERVICES

Service Description:

A. System Startup
1. Manufacturer shall have a factory authorized technician confirm proper installation and operation of all system components. The startup requirement is intended to verify:
a. That all occupancy sensors are located, installed, and adjusted as intended by the factory and the contract documents.
b. The occupancy sensors are operating within the manufacturers specifications.
c. The sensors and relay panels interact as a complete and operational system to meet the design intent.
2. Manufacturer to provide minimum of two day factory start-up at site. Additional days shall be included as required
3. Manufacturer to provide a written statement verifying that the system meets the above requirements.

B. Training
1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and controls.
2. Manufacturer shall provide minimum of one day on site training.
3. Training shall be video recorded and provided to Owner on a DVD.

C. Factory Commissioning
1. Manufacturer shall provide factory authority technician for on site Commissioning Agent Testing. Number of days on-site shall be as necessary based on number of components and systems.
2. Factory Commissioning shall include:

a. Fine tune occupancy sensors.
b. Program daylight harvesting.
c. Program relay panels,
d. Program dimming panels.
e. Fine tune dimming controls.

D. Follow-up Site Assistance

1. The lighting controls representative shall visit the site 11 months post final commissioning to ensure the system is operating appropriately and make any fine-tuning programming adjustments as requested by the owner at that time.

   The controls representative shall also provide an additional 1-day training session for the owner at the 11 month post final commissioning date.

END OF SECTION 26 09 23

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Two-winding transformers.

B. Related Requirements:
   1. Section 03 30 00 - Cast-In-Place Concrete: Housekeeping pads.
   2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   4. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
   5. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA ST 1 - Specialty Transformers (Except General Purpose Type).
   2. NEMA ST 20 - Dry Type Transformers for General Applications.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

C. Test and Evaluation Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

D. Source Quality Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Record Documentation: Record actual locations of transformers.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Product storage and handling requirements.

B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 TWO-WINDING TRANSFORMERS

A. Manufacturer List:
1. Eaton Electrical.
2. General Electrical.
3. Square D.
4. Seimens.

B. Substitution Limitations:
1. General Conditions: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers, ratings as indicated on Drawings.

D. Operation:
1. Primary Voltage: 480 volts, 3 phase.
2. Secondary Voltage: 208Y/120 volts, 3 phase.
3. Insulation system and average winding temperature rise for rated kVA as follows:
4. 1-15 kVA: Class 185 with 115 degrees C rise.
5. 16-500 kVA: Class 220 with 150 degrees C rise.
6. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.
7. Winding Taps:
   a. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
   b. Transformers 15 kVA and Larger: NEMA ST 20.
8. Sound Levels: NEMA ST 20.
9. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.
10. Mounting:
    a. 1-15 kVA: Suitable for wall mounting.
    b. 16-75 kVA: Suitable for wall, floor, or trapeze mounting.
    c. Larger than 75 kVA: Suitable for floor or trapeze mounting.

E. Materials:
1. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.
2. Coil Conductors: Continuous copper windings with terminations brazed or welded.
3. Enclosure: NEMA ST 20, Type 1 or Type 3R ventilated as required to meet service conditions. Furnish lifting eyes or brackets.

F. Fabrication:
   1. Isolate core and coil from enclosure using vibration-absorbing mounts.
   2. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.2 SOURCE QUALITY CONTROL

A. General Conditions: Testing, inspection and analysis requirements.

B. Production test each unit according to NEMA ST20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Requirements for installation examination.

B. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.2 PREPARATION

A. General Conditions: Requirements for installation preparation.

B. Provide concrete pads under provisions of Section 03 30 00.

3.3 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, in accordance with Section 26 05 33, 2 feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Support transformers in accordance with Section 26 05 29.
   1. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.
   2. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure.
   3. Mount trapeze-mounted transformers as indicated on Drawings.

D. Provide seismic restraints.

E. Install grounding and bonding in accordance with Section 26 05 26.

3.4 FIELD QUALITY CONTROL

A. General Conditions: Requirements for inspecting and testing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.2.1.

3.5 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

3.6 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean existing transformers to remain or to be reinstalled.

END OF SECTION 26 22 00

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Distribution and branch circuit panelboards.

B. Related Requirements:
   1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   2. Section 26 05 53 - Identification for Electrical Systems.
   3. Section 26 28 13 - Fuses.

1.2 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers:
   1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
   3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
   4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
   5. NEMA PB 1 - Panelboards.
   6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories Inc.:
   1. UL 50 - Cabinets and Boxes
   2. UL 67 - Safety for Panelboards.
   3. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
   4. UL 1283 - Electromagnetic Interference Filters.
   5. UL 1449 - Transient Voltage Surge Suppressors.
   6. UL 1699 - Arc-Fault Circuit Interrupters.

1.3 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Product Data: Submit catalog data showing specified features of standard products.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

D. Source Quality control submittals: Indicate results of factory tests and inspections.

E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. General Conditions: Requirements for maintenance products.

B. Extra Stock Materials:
1. Furnish two of each panelboard key. Panelboards keyed alike.

1.6 QUALITY ASSURANCE

A. Qualifications
1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

A. Manufacturer List:

Manufacturer	Lighting Panels rated 240V	Lighting Panels rated 480/277V	Distribution Panels rated 600V
Square D	NQOD	NF	I-Line
ABB/GE	AQ	AE	Spectra
Eaton Cutler-Hammer	Pow-R-Line 1A	Pow-R-Line 2A	Pow-R-Line 4B
Siemens	S1	S2	S5

B. Substitution Limitations:
1. General Conditions: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA PB 1, circuit breaker type panelboard. Distribution boards shall be floor mounted.

D. Operation:
   1. Service Conditions:
      a. Temperature: 100 degrees F.
      b. Altitude: 4500 feet.
   2. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.

E. Materials
   1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
   2. Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
   3. Molded Case Circuit Breakers with Current Limiters: UL 489, circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
   4. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
   5. Surge Suppressers: Integrated in panelboard, refer to Section 26 35 53.
   6. Enclosure: NEMA PB 1, Type 1or as required to meet service conditions.
   7. Cabinet Front: Surface door-in-door type, fastened with concealed trim clamps, hinged door with flush lock and plastic directory card holder. Fronts shall have cylindrical tumbler type lock with catch and spring-loaded door pull. All lock assemblies shall be keyed alike.
   8. Circuit breaker accessories: Trip units and auxiliary switches as indicated on drawings.

F. Finishes
   1. Manufacturer's standard gray enamel.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Manufacturer List:

Manufacturer	Lighting Panels rated 240V	Lighting Panels rated 480/277V	Distribution Panels rated 600V
Square D	NQOD	NF	I-Line
ABB/GE	AQ	AE	Spectra
Eaton Cutler-Hammer	Pow-R-Line 1A	Pow-R-Line 2A	Pow-R-Line 4B
Siemens	S1	S2	S5

B. Substitution Limitations:
   1. General Conditions: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

D. Materials:
   1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
   2. For non-linear load applications subject to harmonics furnish 200 percent rated, plated copper, solid neutral.

3. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.
4. Molded Case Circuit Breakers: UL 489, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Provide UL class 760 arc-fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
5. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
6. Enclosure: NEMA PB 1, Type 1 or Type 3R as required to meet service conditions.
7. Split solid neutral shall be plated and located in the main compartment up to 225 amperes so incoming neutral cable may be of the same length. UL listed paneboards with 200% rated solid neutral shall be plated copper for non-linear load applications. Panelboards shall be marked for non-linear load applications.
8. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.
9. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL listed for reverse connection without restrictive line or load markings. Circuit breaker handle accessories shall provide provisions for locking handle in the OFF position.

E. Cabinet Front: Door-in-door Flush or Surface cabinet front as indicated on drawings with concealed trim clamps, concealed hinge, plastic directory card holder, and flush lock keyed alike. Front shall have cylindrical tumbler type lock with catch and spring-loaded door pull. All lock assemblies shall be keyed alike. Finishes:
   1. Finish in manufacturer's standard gray enamel.

2.3 SOURCE QUALITY CONTROL

A. General Conditions: Testing, inspection and analysis requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb.

C. Install recessed panelboards flush with wall finishes.

D. Height: 6 feet (1800 mm) to top of panelboard install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.

E. Install filler plates for unused spaces in panelboards.

F. Provide typed circuit directory for each branch circuit panelboard and load center. Revise directory to reflect circuiting changes to balance phase loads. Identify each circuit as to its clear, evident and specific purpose of use.

G. Install engraved plastic nameplates in accordance with Section 26 05 53.

H. Install spare conduits out of each recessed panelboard to accessible location above ceiling and below slab not on grade. Minimum spare conduits: 5 empty 1 inch (DN27) (above and below). Identify each as SPARE.

I. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

J. Provide each panelboard with nameplate showing panel designation, voltage rating and phase. Indicate source of power (feeder origin) and feeder size (awg/mils and conduit).

K. Label shall be engraved laminated-plastic nameplate. Nameplates shall be black with white letters (normal power) or red with white letters (emergency power).

L. Mount panelboards securely to building structure with 3/8" minimum diameter galvanized bolts and inserts number as required for size of panel, but not less than 4. Mount panelboards with centerline 4'-6" approximately above finished floor with the top a maximum of 74” AFF. Where panels of different heights are mounted adjacent, install top of panel trim at same height above floor. Close all unused openings.

M. Mount feeder panelboards taller than 66" on 4" high 2500# concrete pad and bolt to wall and pad with 1/2" diameter bolts and inserts .Breaker handles in the “ON” position shall not be higher than 6-7” to centerline from the Finished Floor when panelboards are installed on concrete pads

N. Where two sets of feeder cables are required in panel gutter space, run one set in each side of panel.

O. When connecting a panelboard to a transformer, connected conductors shall include a slack 90-degrees bend in flexible conduit between the transformer and any subsequent rigid connection to building structure. Use stranded, flexible conductors to maintain as much flexibility as practical. Do not permit flexible conductors to contact or drape against floor or wall surfaces. The first panelboard, cabinet or switch connected to a transformer shall be resiliently supported from structure by affixing with bolts through holes with grommets (wall supported; equal to Kinetics Model TG Isolation Grommet) or by being set on ¾” thick Neoprene isolation pads (equal to Kinetics Type RSP) sized so that the supported load deflects pads approximately 0.12”, or in the upper half of the manufacturer’s recommended loading range in pounds per square inch. Pad type isolators should use load spreading steel plates to avoid damaging the pad by narrow base rails or sections, as required.

P. Provide seismic bracing in accordance with the manufacturer's recommendations and in compliance with the seismic zone requirements for the zone in which the equipment is located.

Q. Connect only one wire/cable to each breaker terminal.

3.2 FIELD QUALITY CONTROL

A. General Conditions: Requirements for testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.

E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.3 ADJUSTING

A. General Conditions: Requirements for starting and adjusting.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.4 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean interior of panelboards of all debris at substantial completion.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; wall and ceiling occupancy sensors; receptacles; multioutlet assembly; and device plates and decorative box covers.

B. Related Sections:
1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.
2. Section 26 09 23 – Lighting Control Devices; Wall and ceiling occupancy sensors.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 EXTRA MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish two of each style, size, or switch, receptacle type and finish wall plate.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:
1. Cooper Wiring Devices.
2. Hubbell, Inc.
3. Leviton Manufacturing Company.
4. P&S.
5. Substitutions: Upon review.

B. Product Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.

C. Body and Handle: White plastic with toggle handle.

D. Indicator Light: Lighted handle type switch; green color handle.

E. Locator Light: Lighted handle type switch; red color handle.

F. Ratings:
1. 120-277 volts, AC.
2. Current: 20 amperes.

2.2 WALL DIMMERS

A. Manufacturers:
1. Eagle.
2. Hubbell Wiring Devices.
3. Leviton.
4. Lutron.
5. P&S.
6. Synergy Lighting Controls.
7. Substitutions: Not Permitted.

B. Product Description: NEMA WD 1; Semiconductor dimmer for the following load types.
1. Dimmers shall provide full range, continuously variable control of light intensity.
2. Controls shall provide preset single pole, 3-way, or multi-location control from the dimmer location regardless of the position of the other 3-way switch location.
3. Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.
4. Operate at the rated capacity across the full ambient temperature range including modified capacities for ganging configurations with require the removal of fins.
5. Control should be designed to not interfere with audio, video, or radio equipment.
6. Utilize air gap off, activated when user selects “off” at any control to disconnect the load from line supply eliminating any leakage current.
7. Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption.
8. Designed and tested with withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.
9. Design and test dimmers to withstand line-side surges without impairment to performance when subjected to surges of 6,000 volts, 200 amps per ANSI/ IEEE C62.41C.
10. Capable of operating at the rated capacity; this includes modified capacities for ganging configurations which require the removal of fins. Operation at rated capacity shall be possible across the full ambient temperature range, without shortening design lifetime.

C. Load Specific Requirements: Within rated capacity, dimmers shall be available for direct control of the following loads.
1. Dimming LED Lamps:
a. Contain circuitry specifically designed to control dimmable self ballasted CFL loads.
b. Provide with lower dimming range adjustment.
c. Listed to UL 172.
2. Electronic Low Voltage (ELV):
a. Dimmers shall contain circuitry specifically designed to control the input of electronic solid state low voltage transformers.

b. Shall have a maximum output of no less than 92% of line voltage.
c. Dimmers using standard phase control shall not be acceptable.

3. Fan Speed Control:
   a. Fully Variable fan speed controls for paddle fans, ventilation fans and exhaust fans.
   b. Quiet fan speed controls shall provide low-medium-high speeds settings and off.
   c. Shall be listed to UL 1917.
4. Remote Dimming Modules:
   a. Provide high power module and wall dimmer from a single manufacturer.
   b. High power module listed to UL 508 for control of incandescent/ halogen, magnetic low voltage, electronic low voltage, fluorescent, and neon/cold cathode loads. Provide high power modules as defined on project drawings.

D. Body and Handle: White Nylon or match existing with linear slide.

E. Voltage: 120 or 277 volts.

F. Power Rating: Match load shown on drawings; 600 watts minimum.

G. Accessory Wall Switch: Match dimmer appearance.

2.3 OCCUPANCY SENSORS AND POWER PACKS

A. Occupancy Sensors

1. Ceiling sensors.
2. Wall sensors.
3. Dual technology sensors shall:
   a. Either corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas
   b. Passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
4. Ultrasonic sensors shall:
   a. Utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.
   b. Have an ultrasonic operating frequency that is crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
5. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
6. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
7. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
8. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
9. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

B. Products
   1. Wall Mounted Single Level Motion Sensor Switch.
   2. Wall Mounted Bi-Level Motion Sensor Switch.
   3. Ceiling Mounted Dual Technology Occupancy Sensor with Power Pack.

C. Circuit Control Hardware – (Power Packs)
   1. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
   2. Provide power packs as required. Power Pack shall be installed in jbox.
   3. Relay Contacts shall have ratings of:
      a. 13A - 120 VAC Tungsten
      b. 20A - 120 VAC Ballast
      c. 20A - 277 VAC Ballast
      d. 20A – 347 VAC Ballast

D. Control wiring between sensors and control units shall be Class II, 18-20 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
   1. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

E. Mount switches and occupancy sensors as indicated on Drawings and by manufacturer's requirements.

CONTROL TYPE	**COMMISSIONING AND CALIBRATION**
Occupancy sensors	Ensure that the sensor is correctly placed and oriented per the specifications and/ or construction drawings. If unanticipated obstructions are present, it may be necessary to adjust the sensor location and orientation.
Occupancy sensors	Adjust the sensitivity and time delay of the occupancy sensor, and test to ensure it provides appropriate response. For optimal user acceptance, energy savings and lamp life, set the time delay initially for a minimum of 15 minutes (NEMA recommendation).
Manual dimming	Ensure correct placement of the dimmer per the construction drawings. Adjust the upper limit of the dimming range according to the task being performed, and set the lower limit of the range so that the minimum light level meets the use/application of the space.

2.3 RECEPTACLES

A. Manufacturers:
   1. Cooper Wiring Devices.
   2. Harvey Hubbell, Inc.
   3. Leviton Manufacturing Company.

4. P&S.
5. Substitutions: Not permitted.

B. Product Description: NEMA WD 1, Heavy-duty general use receptacle.
1. Receptacles shall be Tamper-Resistant where required by section 406.12 of the National Electrical Code, 2017.

C. Device Body: White nylon.

D. Configuration: NEMA WD 6, type as indicated on Drawings.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.4 WALL PLATES

A. Manufacturers:
1. Cooper Wiring Devices.
2. Harvey Hubbell, Inc.
3. Leviton Manufacturing Company.
4. P&S.
5. Substitutions: Not permitted.

B. Decorative Cover Plate: White nylon.

C. Jumbo Cover Plate: White nylon.

D. Weatherproof Cover Plate: Gasketed cast metal plate with hinged and gasketed cast metal cover device cover. The system shall be weatherproof while in use.

E. Wall plates for devices in laboratories, kitchen areas, mechanical rooms, where located on CMU/block Surface and other similar areas shall be beveled edge stainless steel plates, single or multi-gang as required by the outlet. Wall plates for devices in surface boxes, unless specified otherwise, shall be beveled edge satin finish stainless steel plates, single or multi-gang as required by the outlet. Blank plates shall be furnished and installed on all empty, blanked or unused outlets. Device plates manufactured by device manufacturer where available. Wall Plates shall be single and combination types that mate and match with corresponding devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on bottom.

F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

G. Install wall plates on flush mounted switches, receptacles, and blank outlets.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping solid conductor around screw terminal. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

J. Use jumbo size plates for outlets installed in masonry walls.

K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

L. Match devices to plug connectors for Owner-furnished equipment. Verify type, configuration, etc., prior to providing devices. Including all such costs in bid submission.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as indicated on drawings.

B. Install wall switch 48 inches above finished floor.

C. Install convenience receptacle 18 inches above finished floor.

D. Install convenience receptacle 6 inches above back splash of counter.

E. Install dimmer 48 inches above finished floor.

3.5 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. General Conditions: Final cleaning.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fuses and spare fuse cabinet.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 DESIGN REQUIREMENTS

A. Select fuses to provide appropriate levels of short circuit and overcurrent protection for the following components: wire, cable, bus structures, and other equipment. Design system to maintain component damage within acceptable levels during faults.

B. Select fuses to coordinate with time current characteristics of other overcurrent protective elements, including other fuses, circuit breakers, and protective relays. Design system to maintain operation of device closest to fault operates.

1.4 FUSE PERFORMANCE REQUIREMENTS

A. Main Service Switches Larger than 600 amperes: Class L (time delay).

B. Main Service Switches: Class RK1 (time delay).

C. Power Load Feeder Switches Larger than 600 amperes: Class L (time delay).

D. Power Load Feeder Switches: Class RK1 (time delay).

E. Motor Load Feeder Switches: Class RK1 (time delay).

F. Lighting Load Feeder Switches Larger than 600 amperes: Class L time delay.

G. Lighting Load Feeder Switches: Class RK1 (time delay).

H. Other Feeder Switches Larger than 600 amperes: Class L time delay.

I. Other Feeder Switches: Class RK1 (time delay).

J. General Purpose Branch Circuits: Class RK1 (time delay).

K. Motor Branch Circuits: Class RK1 (time delay).

L. Lighting Branch Circuits: Class G.

1.5 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents: Record actual sizes, ratings, and locations of fuses.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 MAINTENANCE MATERIALS

A. General Conditions: Spare parts and maintenance products.

1.9 EXTRA MATERIALS

A. General Conditions: Requirements for extra materials.

B. Furnish 20% spare fuses of each Class, size, and rating installed.

PART 2 - PRODUCTS

2.1 FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut
3. Substitutions: General Conditions

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.2 CLASS RK1 (TIME DELAY) FUSES

A. Manufacturers:
1. Bussman.
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.3 CLASS RK1 (NON-TIME-DELAY) FUSES

A. Manufacturers:
1. Bussman.
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.4 CLASS RK5 FUSES

A. Manufacturers:
1. Bussman.
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.5 CLASS J (TIME DELAY) FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.6 CLASS J (NON-TIME-DELAY) FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut.
3. Substitutions: General Conditions

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.7 CLASS L (FAST-ACTING) FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut.
3. Substitutions: General Conditions.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.8 CLASS L (TIME DELAY) FUSES

A. Manufacturers:
1. Bussman
2. Gould Shawmut.
3. Substitutions: General Conditions

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.9 SPARE FUSE CABINET

A. Product Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.

B. Doors:Hinged, with hasp for Owner's padlock.

C. Finish: Gray enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuse with label oriented so manufacturer, type, and size are easily read.

B. Install spare fuse cabinet at location as directed by Owner.

END OF SECTION 26 28 13

SECTION 26 28 19 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fusible.
   2. Nonfusible switches.

B. Related Requirements
   1. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   2. Section 26 05 53 - Identification for Electrical Systems.
   3. Section 26 28 13 - Fuses.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Description: NEMA KS 1, Type HD (Heavy Duty), enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Operation:

1. Switch Ratings
    a. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
    b. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere). 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

C. Materials:
1. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
2. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
    a. Interior Dry Locations: Type 1.
    b. Exterior Locations: Type 3R.
3. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
4. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Description: NEMA KS 1, Type HD (Heavy Duty) enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Operation:
1. Switch Ratings
    a. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
    b. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere).

C. Materials:
1. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
    a. Interior Dry Locations: Type 1.
    b. Exterior Locations: Type3R.
2. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
3. Furnish switches with entirely copper current carrying parts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches where indicated. Secure switches to building or equipment surface as shown. Where the surface is not adaptable for mounting, provide unistrut P-1000 rack mounted as required to secure switch.

B. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

C. Height: 5 feet (1500 mm) to operating handle.

D. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

E. Install engraved plastic nameplates in accordance with Section 26 05 53. Engrave nameplates with the equipment served and the panel and circuit number supplying the switch.

F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

G. Secure switches and circuit breakers to building structure in accordance with seismic zone specified in other sections of this specification.

H. All exterior mounted switches shall comply with NEC 312.2.

I. All switches shall be mounted to comply with NEC 404.8.

3.2 FIELD QUALITY CONTROL

A. General Conditions: Requirements for testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

3.3 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean existing enclosed switches to remain or to be reinstalled.

END OF SECTION 26 28 19

SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior luminaires, lamps, ballasts, and accessories.

B. **LIGHTING AGENCIES, DISTRIBUTORS, ETC. ARE REQUIRED TO HAVE A COMPLETE FIXTURE SCHEDULE, ALL LIGHTING PLANS, ARCHITECTURAL REFLECTED CEILING PLANS AND SPECIFICATIONS IN ORDER TO BID THE PROJECT. PRICING SHALL NOT BE BASED ON CATALOG NUMBERS ALONE. COORDINATE AND PROVIDE ALL MOUNTING HARDWARE AND ACCESSORIES AS REQUIRED BY ARCHITECTURAL CEILING TYPES AND CEILING TILE CONFIGURATIONS. CHANGE ORDERS WILL NOT BE ALLOWED FOR FAILURE TO USE THE COMPLETE SET OF PLANS FOR BID PURPOSES.**

C. Related Sections:
   1. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables
   2. Section 26 05 23 – Lighting Control Devices
   3. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI_NEMA_ANSLG C78.377-2008 Specifications for the Chromaticity of Solid State Lighting Products.

B. Illuminating Engineering Society (IES)
   1. IES LM-79-08
   2. IES LM-80-08

C. US Department of Energy
   1. Lighting Facts

1.3 SYSTEM DESCRIPTION

A. Catalog numbers indicated in the Luminaire Schedule are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of light bar, driver, finish trim, ceiling type, mounting hardware or special requirements as specified or as required by the particular installations. Provide complete luminaire to correspond with the features, accessories, number of LED's, wattage and/or size specified in the text description of each luminaire type. Additional features, accessories and options specified shall be included.

Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed luminaires shall have frames that are compatible with the ceiling systems.

B. Luminaire voltage shall match the voltage of the circuit serving same.

1.4 SUBMITTALS

A. SUBSTITUTIONS

1. See General Conditions of the specifications for information regarding substitutions. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples if requested by Engineer are provided. Alternate products shall meet or exceed design criteria.

2. If submitted fixtures are not as specified, provide footcandle calculations showing the actual rooms, correct ceiling heights, mounting heights, and surface reflections. Provide IES files in digital format of all substituted fixtures to the Engineer for review. The engineers model will not be provided for this purpose. The lighting representative shall produce all required files and documentation to the satisfaction of the Engineer.

B. PRODUCT DATA

For each type of luminaire, arranged in order of luminaire designation. Include data on features, accessories, finishes, and the following:

1. Material and physical description of luminaire including dimensions.
2. Emergency lighting units including battery and charger.
3. Energy-efficiency data.
4. Life, output (lumens, CCT, and CRI), Kelvin temperature, and energy-efficiency data for LED light bars.
5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each luminaire type. The adjustment factors shall be for light bars, drivers, and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer. LM-79 and LM-80 data for solid state lighting.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Photometric data, certified by a qualified independent testing agency, in IESNA format, based on certified results of laboratory tests of each luminaire type, outfitted with light bars, drivers and accessories identical to those indicated for the luminaire as applied in the Project.
7. Low voltage transformers.
8. LED power supplies.
9. Types of LED's, including manufacturer, wattage, and Color Rendering Index (CRI) and color temperature in degrees Kelvin (K).

C. SHOP DRAWINGS

1. Show detail of nonstandard or custom luminaires.
2. Indicate dimensions, weights, method of field assembly, components, features and accessories.
3. For custom luminaires, modified luminaires or linear luminaires mounted in continuous rows, submit scaled drawings prepared by the manufacturer showing all details of construction, lengths in runs, pendant or power feed locations, accessories, finishes and lists of materials.
4. This Contractor shall provide the manufacturer with accurate field dimensions where required.
5. Include wiring diagrams, power and control wiring.

D. Wiring diagrams shall detail wiring for luminaires and differentiate between manufacturer installed and field installed wiring.

E. Dimming Driver Compatibility Certificates shall be signed by the manufacturer of driver certifying that drivers are compatible with dimming systems and equipment with which they are used.

F. Maintenance Data shall be provided for luminaires and equipment to include in emergency, operation and maintenance manuals specified in specifications section describing Operations and Maintenance Data.

G. Field quality control test reports.

H. Special Warranties specified in the Section.

I. Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall not be considered to be approval of said voltage, mounting condition or quantities. This Contractor shall field verify voltage and actual mounting condition and method.

J. Product samples complete with housing, trim, specified lumen package, and 8’ cord with plug for 120 V shall be submitted if requested.

1.5 CUSTOM LUMINAIRES

A. All custom luminaires require a prototype to be submitted prior to commencement of fabrication. The purpose of the prototype will be to review construction, LED placement within luminaire, LED type, optical assembly, finishes, etc. Modifications may be required as a result of prototype review. These modifications and others that do not materially affect the cost of the luminaire shall be incorporated at no additional cost to the Owner, Architect, or Engineer.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and luminaires to include in emergency, operation, and maintenance manuals.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authorities Having Jurisdiction, and marked for intended use.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Comply with NFPA 70.

E. Designated manufacturers are listed to define the requirements for quality and function of the specified product.

F. Mockups: Provide interior luminaires for room or module mockups complete with power and control connections.

1. Obtain Lighting Designer's and Architect's approval of luminaires for mockups prior to starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Remove mockups when directed. Luminaires may be reinstalled in the Work with approval from the University.
4. Install luminaires for mockups with power and control connections.
5. Mockups evaluated on the Project site may become part of the complete Work with the approval of the University, Lighting Designer and Architect if the mockup is undisturbed at the time of substantial completion.

1.8 COORDINATION

A. Coordinate layout and installation of luminaires with ceiling system and other construction that penetrates ceilings or is supported by them including mechanical system, fire suppression, and technology and partition assemblies.

B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation.

C. Recessed luminaires shall have frames that are compatible with the ceiling system indicated on the Architectural Drawings.

D. Coordination Meetings: This Contractor shall meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each luminaire mounting condition with ceiling type. During second meeting, coordinate luminaire layout in each area. This Contractor shall meet at least twice with the mechanical systems installer prior to fabrication and installation of ductwork. Coordinate depth and location of all luminaires with ductwork, fire suppression, and technology in all areas.

1.9 MAINTENANCE MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish two of each plastic lens type.

C. Furnish 10% of each type of driver type.

D. Furnish five (5) of each type of exit sign.

1.10 SUPPORT AND BRACING

A. All luminaires shall be installed with supports and bracing required for the seismic zone in which the project is located. See Spec Section 26 05 30.

B. Contractor to provide and install any hangars and supports to suspend or attach fixtures to locations as shown on reflected ceiling plans. Including any trapeze assemblies or special installation techniques to achieve installation in the desired locations. See all other project documentation for other systems that may conflict with traditional support methods.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Recessed Luminaires: Comply with NEMA LE 4 for ceiling compatibility for recessed luminaires.

B. Luminaires: Comply with UL 1598.

C. Metal Parts: Free of burrs, sharp corners and edges. Metal work shall be free of tool marks and dents and shall have accurate angles bent as sharply as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All miters shall be in accurate alignment with abutting intersection members.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging. Luminaires to be painted after fabrication. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.

E. Luminaire hardware to comply with the following material standards: For steel and aluminum luminaires, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel luminaires, all hardware shall be stainless steel.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Safety devices shall be detachable if necessary and shall not interfere with luminaire performance, maintenance or the seating of any luminaire element. Safety device shall not be visible during normal luminaire operation and from normal viewing angles.

G. Luminaires provided shall have means for disconnection from power source during service, as required in NEC Article 410.

H. Reflecting Surfaces: Minimum reflectance as follows, unless indicated otherwise:

1. White Surfaces: 85%
2. Specular Surfaces: 90%
3. Diffusing Specular Surfaces: 75%

I. Reflector cones shall adhere to the following:

1. Cones shall provide a minimum of 50-degree cutoff to source and source image.
2. Plastic material shall not be used for reflector cones.
3. Cones shall not be permanently fastened to the housing and shall be removable without tools. Retention devices shall not deform the cone or be visible from normal viewing angles.
4. Trim shall be flush to ceiling without gaps or light leaks. Where the flange trim is separate from the cone, it shall have the same finish as the reflector cone.
5. Reflector cones shall be uniform gauge, not less than 0.032” thick, high purity aluminum Alcoa 3002 alloy. Cones shall be free from spin marks or other defects.
6. Manufacture cones using the Alzak® process. Refer to Luminaire Schedule for cone color and finish, i.e., specular or diffuse requirements.

J. Lenses, Covers, Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100% virgin acrylic plastic. UV stabilized high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
   b. Lenses shall have uniform brightness throughout the entire visible area without LED pixelation.

2. Glass Globes: Annealed crystal glass unless otherwise indicated.

K. Adjustable luminaires shall have positive locking devices to fix aiming angle. Luminaires shall be capable of being relamped without adjusting aiming angle.

L. Each luminaire that has an array with a beam pattern or a spread lens that defines beam orientation shall contain locking devices to insure the orientation is not disturbed during array replacement or cleaning.

M. All luminaires and drivers shall operate within the temperature limits of their design and as specified by UL in the applications and mounting conditions specified.

N. Luminaires recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to NEC Article 300-22.

O. Provide plaster frame for recessed luminaires mounted in other than T-bar ceilings. Verify mounting with architectural reflected ceiling plan before ordering luminaires.

P. Fixtures installed in “hard” ceilings shall have all connections accessible through the luminaire.

Q. For weatherproof or vapor-tight installations, finishes of luminaires and accessories shall be a premium 5 stage TGIC polyester powder coat paint minimum 2.5 mils thick, applied to factory-assembled and -tested luminaires before shipping, so that the entire assembly is completely corrosion resistant for the service intended. Exterior finishes shall have an outdoor life expectancy of not less than 20 years without any visible rust or corrosion. Where aluminum parts come in contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.

R. Luminaires for use in areas designated as damp locations shall be suitable gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation openings. Dissimilar metals shall be separated by non-conductive material to prevent galvanic action.

S. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when light bars are in place.

T. Luminaires shall be free of light leaks while providing sufficient ventilation of LED’s and drivers to provide the required photometric performance.

U. Luminaires shall hold LED arrays securely against normal vibration and maintenance handling.

2.2 LED LUMINAIRES

A. Shall be tested according to the Illuminating Engineering Society of North America (IESNA) LM-79 and LM-80.

1. Shall supply third party testing and data in compliance with Commercially Available LED Product Evaluation and Reporting (CALiPER) or National Voluntary Laboratory Accreditation Program (NVLAP).
2. The testing laboratory must be listed on the U.S. Department of Energy's Solid-State Lighting website as an accredited testing laboratory.
3. Manufacturers shall provide supporting evidence of lamp life calculation based on junction temperature and drive current upon request.

B. Shall be listed and labeled in accordance with the U.S. Department of Energy Lighting Facts Program.

C. Shall provide independent test laboratories IES photometrics which verify light levels.

D. Correlated Color Temperature (CCT) measured in Kelvin's shall meet Nominal CCTs and tolerances as defined in ANSI_NEMA_ANSLG C78.377-2008.
1. Nominal CCT: 3000 K: 3045 ± 175 K or
2. Nominal CCT 3500 K: 3465 ± 245 K
3. Nominal CCT: 4000 K: 3985 ± 275 K or
4. Nominal CCT 4500 K: 4503 ± 243 K
5. Nominal CCT 5000 K: 5028 ± 283 K or
6. Nominal CCT 5700 K: 5665 ± 355 K
7. Nominal CCT: 6500 K: 6530 ± 510 K

E. Minimum CRI > 80 or as noted in the fixture schedule.

F. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.

G. Luminaires shall have internal thermal protection.

H. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

I. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management

J. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.

K. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.

L. Power Supplies and Drivers

1. Power Factor: 0.90 or higher
2. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
3. Output operating frequency: 60Hz.
4. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
5. Total Harmonic Distortion Rating: 20% Maximum.
6. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
7. Fully dimmable, 0 – 10 VDC standard.

8. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
9. Compatibility of dimming switches: Certified by manufacturer for use with individually specified luminaire and individually specified control components.

M. LED ARRAYS

1. All LED's of the same type are to be provided by the same manufacturer.
2. Equip each luminaire with the proper LED array of the type shown or specified in the Luminaire Schedule.

N. WIRING

1. No internal wiring shall be visible at normal viewing angles.

2.6 RECESSED LUMINAIRES

A. Furnish all recessed luminaires in compliance with U.L. Standards for:
   1. Suspended Ceilings Non-Type I.C.
      a. Where luminaire is used in a suspended ceiling.
   2. Thermally Protected Fixture - Non-Type I.C.
      a. Where luminaire is installed in a ceiling with the possibility of overheating.
   3. DC - IC Luminaire - Type I.C.
      a. Where luminaire is intended to be installed where direct contact with insulation is expected.

B. Check Architectural drawings, sections and specifications for insulation methods and ceiling types for additional information to determine the correct method to furnish luminaires for U.L. compliance.

2.7 STEMS

A. Ball aligned, swivel 30 or 45 degrees from vertical with swivel below canopy. Painted same color as luminaire trim unless otherwise noted.

2.8 EXIT LIGHTS

A. Exit lights furnished with 6" high stencil letters. Use green LED's. Verify color used with local codes, if a different color is required, indicate on the shop drawing submittal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Support of luminaires responsibility of this Section.

B. See Spec Section 26 05 30, Seismic Protection for Electrical Equipment for additional requirements.

C. Fixtures mounted in grid ceilings and in hard ceilings shall be supported independently of the ceiling or ceiling grid. See details on plans. For recessed fixtures in hard ceilings provide one support at each corner of 2' x 4' and larger luminaries and one at each end at opposite corners of 1' x 4' and 2' x 2' luminaries. In hard ceilings, galvanized hanger wires may be used.

D. Provide devices for securing luminaire to ceiling grid to comply with Article 410-16(c) of National Electrical Code. ("Earthquake Clips").

E. Wire luminaires with flexible conduit individually to junction boxes. Do not wire luminaire to luminaire.

F. Support recessed luminaires with 3/4" black iron ceiling channel, one piece on each side of luminaire, anchored to ceiling system. Support large recessed luminaires over 20 pounds independent of furred ceiling system with rods, size as required, anchored to structure.

G. Support surface and pendant luminaires from 3/8" fixture stud in outlet box. Large surface or pendant luminaires (in excess of 20 pounds) with 3/8" rod run through the outlet box to structure and anchored independent of ceiling and conduit systems.

H. Provide plaster frames for recessed luminaries in plaster and concealed spline ceilings supported independent of ceiling construction with 1/4" rod anchored to structure.

I. Individual flexible connections to luminaires shall be made with 2#14 and 1#14 (ground) THHN-2 in 3/8" flexible conduit not to exceed 6'. Bond ground wire at each end. Provide additional wire(s) as required for a/b and similar switching schemes.

J. Stems on linear luminaires shall be installed as follows (except luminaires with slide grip hangers): First and last stem in row shall be installed in first knockout from end of luminaires; one stem shall be installed between each two luminaires connect intermediate stems to center joint where luminaires join and attach by use of "joining plates". Provide adequate number of stems to completely support luminaires and keep luminaires aligned straight and plumb.

K. Connect luminaires in continuous rows other than recessed grid type connected by nipples with locknuts and bushings.

L. Furnish complete manufacturers shop drawing for continuous luminaires showing mounting, ceiling interface and complete luminaire layout.

M. Refer to architectural reflected ceiling plans for coordination of luminaire locations with mechanical, fire protection, technology and fire safety equipment. Where conflicts occur, coordinate with Architect, Engineer and Lighting Designer prior to installing any of the Systems.

N. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

O. Luminaires located in recessed ceilings with a fire resistive rating of 1 hour or more shall be enclosed in an approved fire resistive rated box equal to that of the ceiling. Acoustical ceiling tiles are not acceptable.

P. Install recessed luminaires to permit removal from below.

Q. Install recessed luminaires where installed in rated assemblies using accessories and firestopping materials to meet regulatory requirements for fire rating.

R. Install wall-mounted luminaires at height as indicated on Drawings.

S. Remote mounting of drivers: Distance between the driver and fixture shall not exceed that recommend by manufacturer. Verify the maximum distance between the driver and luminaire with the manufacturer.

T. Pendant Mounted Fixtures

1. Where suspended below accessible ceiling, provide structural support at suspended ceiling level from structural members above ceiling. Do not run hanger rods through ceiling.
2. Continuous Runs of Luminaires: Laser sight to insure luminaires are straight and true when sighting from end to end, regardless of irregularities in the ceiling. Where luminaires are so installed, omit ornamental ends between sections. All seams/joints shall be tightly fitted.
3. All power feeds shall originate from the same location/end of each run.

U. Install accessories furnished with each luminaire.

V. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

W. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.2 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Aim and adjust luminaires as indicated on Drawings.

3.4 CLEANING AND ADJUSTING

A. Remove protective plastic covers from luminaires and luminaire diffusers only after construction work, painting and clean-up are completed. Remove, clean, and reinstall all dirty reflectors and diffusers.

B. Clean luminaires internally and externally after installation. Use methods and materials recommended by manufacturer for cleaning Alzak reflectors and other surfaces.

C. Make final adjustment of aimable luminaires and adjustable light settings under the direction of the Architect and/or Lighting Designer during a scheduled period of time prior to the completion of the Project, after normal business hours if required. Include all equipment and personnel expenses including overtime required for focusing.

3.5 PROTECTION OF FINISHED WORK

A. General Conditions: Protecting finished work.

B. Replace all inoperable LED arrays at the end of construction prior to substantial completion.

3.6 GUARANTEE

A. All luminaires, components, accessories etc., shall be guaranteed against defects in materials and workmanship for five (5) years from date of in-service acceptance by owner. Replacement shall include parts and labor at the site of the work for the term of the warranty.

3.6 PROJECT CLOSEOUT

A. The contractor and lighting representative shall demonstrate maintenance procedures for replacement and renewal of each individual fixture type with facilities maintenance staff upon project completion. The contractor shall remove and re-install each replaceable component within each fixture type in the presence of the owner.

END OF SECTION 26 51 00

SECTION 26 60 00 – ELECTRICAL SYSTEMS TESTING

PART 1 – GENERAL

A. The Contractor shall retain the services of an independent testing firm to perform International Electrical Testing Association (NETA) testing. Testing services shall be as described in this specification and shall be paid for and coordinated by the Contractor.

B. NETA testing procedures and requirements for tested values shall be in accordance with the most current edition of the NETA Acceptance Testing Specifications.

C. Any deficiencies or failures discovered during the NETA testing procedures shall be promptly corrected by the Contractor to ensure timely completion of the project and to minimize the time required for the independent testing firm to complete their work.

D. Independent testing firms shall be as listed below or approved equal.

A.Nat'l Field Services
B.Electrical Professional Consultants
C.Electrical Reliability Services | Vertiv

1.1 TEST REPORTS

A. Intermediate Test Reports

1. Intermediate test reports shall be issued by the independent testing firm immediately following each site visit. Intermediate test reports shall identify the general results of all field testing and field observations, and shall specifically identify any deficiencies, problems, or failures noted during the site visit.

2. Intermediate test reports shall be issued/distributed to the electrical subcontractor, the general contractor, the electrical engineer, and to the Owner. The intent of this direct communication and/or notification to multiple parties is to ensure the 'independent' function of the independent testing firm and to prevent such information from being delayed or filtered by processing it through the electrical subcontractor and/or the general contractor.

B. Final Test Report

1. The final test report shall be issued by the independent testing firm following successful completion all required electrical systems testing. The final test report shall be typed, bound, and indexed, and shall include a cover page that identifies the project name, project location, and project number. The final test report shall include a separate section for each area of required testing (tests as summarized below).

a. Grounding Systems
b. Ground Fault Protection Systems
c. Circuit Breakers (Over 100 Amps)
d. Transformers (Dry Type)
e. Low Voltage Feeders (up to 600 Volts) Serving Loads of 100 Amps or Greater
f. Main Switchboard
g. Distribution Boards
h. Branch Circuit Panelboards

1.2 TESTING REQUIREMENTS

A. Grounding Systems

1. The following grounding system testing shall be conducted on two separate occasions, once prior to initializing electrical power for construction activities, and once when all electrical systems have been finalized.
2. Perform fall-of-potential testing of the main grounding electrode or grounding system in accordance with IEEE Standard No. 81. If suitable locations for test rods are not available, a low resistance dead earth or reference ground shall be utilized.
3. Perform point-to-point testing to determine the resistance (bonding) between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.
4. Measure system neutral-to-ground insulation resistance with the neutral disconnect link temporarily removed (replace neutral disconnect link after testing).
5. This testing shall be performed at the origination point of all separately derived systems.
6. Verification shall be made that the grounding electrode system is installed per NEC at all connection points.

B. Ground Fault Protection Systems

1. Perform pickup tests utilizing primary injection. Verify that the relay does not operate at 90% of the pickup setting. Verify pickup is less than 125% of setting or 1200 amps (whichever is less).
2. On summation type systems utilizing phase and neutral current sensors verify correct polarities by applying current to each phase-neutral current transformer pair).
3. Measure time delay of the relay at 150% of pickup or greater by injecting current into the sensor. Total trip time shall be electronically monitored.
4. Verify that the reduced control voltage tripping capability is 55% of rated voltage for systems with external control power (reference UL-1053).
5. Test zone interlock systems by simultaneous sensor current injection and monitoring of zone blocking function.

C. Circuit Breakers (Over 100 Amps)

1. Test requirements apply to adjustable molded case, insulated case, and metal frame circuit breakers.
2. Measure contact resistance by millivolt drop method at rated current or by digital low resistance ohmmeter method.
3. Test insulation resistance from pole-to-pole and from pole-to-ground with breaker closed and across open contacts of each phase.
4. Adjust trip settings in accordance with coordination study.
5. Measure instantaneous pickup current by primary current injection.
6. Measure long-time pickup and delay by primary current injection.
7. Measure short-time pickup and delay by primary current injection.
8. Verify trip unit reset operation.

D. Transformers (Dry Type)

1. Test insulation resistance winding-to-winding and winding-to-ground and calculate the polarization index.
2. Test turns ratio between windings for all tap positions. Verify that winding polarities match the transformer nameplate.
3. Measure resistance of each high voltage winding in each no-load tap-changer position. Also measure resistance of each low voltage winding in each load tap-changer position (when applicable).

E. Low Voltage Feeders (up to 600 Volts) Serving Loads of 100 Amps or Greater

1. Conduct megohm (Megger) testing of shield continuity resistance utilizing a megohmmeter.
2. Test insulation resistance phase-to-ground and phase-to-phase for one minute.
3. Test voltages shall be as recommended by the feeder manufacturer (or by NETA Acceptance Testing Specification).

F. Main Switchboard

1. Review cable testing report for each conductor.
2. Record all circuit breaker settings and very that each setting is in accordance with the coordination study.
3. Test and verify the accuracy of the load meter in each function and verify values can be seen on the campus control system.
4. Test and verify the operation of the shunt trip mechanism.
5. Inspect installation and functions of the surge suppression device and verify SPD lengths are as short as possible.

G. Distribution Boards

1. Review cable testing report for each conductor.
2. Record all circuit breaker settings and very that each setting is in accordance with the coordination study.
3. Inspect installation and functions of the surge suppression device and verify SPD lengths are as short as possible.

H. Branch Circuit Panels

1. Review cable testing report for each conductor.
2. Record all circuit breaker settings and very that each setting is in accordance with the coordination study.

END OF SECTION 26 60 00

SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. Include all labor, materials, tools, transportation, storage costs, excavation, training, equipment, insurance, temporary protection, permits, inspections, taxes and all necessary and related items required to provide complete and operational telecommunications, video surveillance, and clock/paging systems as shown on the Drawings and described in the Specifications. Access-control and intrusion-detection work is limited to existing systems or rough-in where specifically shown on the Drawings; active access-control and intrusion-detection equipment, programming, and commissioning are not included unless expressly indicated.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 05 43: Exterior Communications Pathways
4. 27 08 00: Commissioning of Communications
5. 27 11 00: Communications Equipment Room Fittings
6. 27 15 00: Communications Horizontal Cabling
7. 27 51 13: Paging Systems
8. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 QUALITY ASSURANCE

A. The Contractor installing communications cabling and termination equipment shall have a minimum of (5) years experience installing communications systems of similar size and scope.

B. The Contractor must be licensed by the Nevada State Contractors Board.

C. Formal, written evidence of the following shall be presented to the WCSD Project Manager during the BID process and before contract is awarded:

1. The Contractor, including any subcontractor, must have BICSI® Registered Installers and Technicians on staff and assign them to the Project. The project shall be staffed at all times by Installers and Technicians who, in the role of lead craftsperson, shall be able to provide leadership and technical resources for the remaining craftspersons on the project. At all times, a minimum of 30 percent of

on-site Contractor personnel shall be BICSI® registered communications installers. The Field Supervisor must be a BICSI® Technician or RCDD.

2. If requested, the Contractor, including any subcontractor, shall show proven expertise in the implementation of communications projects including details of at least three projects involving the design and installation of Category 6 unshielded twisted-pair cabling systems and optical fiber cabling systems within the past two year period. Names, addresses, and telephone numbers of references for the three projects shall be included.
3. The Contractor shall accept complete responsibility for the design, installation, acceptance testing and certification of the Belden 10GX, 2400 and/or IBDN FiberExpress System. Objections to the design shown on the Drawings and Specifications shall be made prior to bidding the project.
4. In the event subcontractors are used for any portion of the installation or acceptance testing, The Contractor shall be responsible for any subsequent corrective action required on that portion.

D. Manufacturer Product Data Sheets

1. Submit product data sheets in electronic PDF (portable document format).
2. Provide table of contents for each submittal indicating the items being submitted. Products listed in the table of contents should be in the same order as they appear in the Specifications.
3. Provide product data sheets for all items listed in each specification section. Partial submittals will not be accepted.
4. Where product data sheets include more than one distinct item, clearly mark data sheet with arrow or other identifying means to indicate the items being submitted for approval. Delete or cross-out all non-applicable data.

E. Shop Drawings and Coordination Drawings

1. Submit shop drawings and coordination drawings in electronic PDF (portable document format).
2. Shop drawings and coordination drawings shall bear the stamp of approval of the Communications Contractor as evidence that they have checked the drawings. Drawings submitted without this stamp of approval will not be considered and will be returned for proper resubmission. All shop drawings shall be submitted as a single complete package. Partial packages will not be reviewed.
3. Shop drawings and coordination drawings must be submitted and approved prior to the installation of the work. Installation of work prior to the submittal and approval of the shop drawings will proceed at the contractor’s risk.
4. See individual Division 27 specification sections for specific shop drawing and coordination drawing requirements. At a minimum, drawings shall be submitted for the following items:

    a. Routing of conduits 2” and larger.
    b. Routing of basket tray and or cable tray.
    c. Routing of telecom cable pathway in telecom equipment rooms.
    d. Layout of floor and wall mounted equipment in telecom equipment rooms.

F. Cable Test Reports

1. Submit test reports signed and dated by the technician performing the cable testing.

G. Retain communications work for video surveillance, clock/paging, AV, and structured cabling as shown and as coordinated with WCSD-SCS-015. (dated March 13, 2023)

H. Access control and intrusion detection are not active system scopes under this Section, except for rough-in and existing-system coordination where specifically shown on the Drawings.

I. Other Submittals

1. See individual Specification Sections for requirements.

1.4 REGULATIONS AND CODE COMPLIANCE

A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and Local applicable codes and ordinances.

B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

C. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations of the telecommunications industry, as well as federal, state and local governmental agencies, including, but not limited to the following:

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
4. ANSI/TIA-568.3-E: Optical Fiber Cabling and Component Standard (Revision E, September 2022).
5. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
6. ANSI/TIA-598-D: Optical Fiber Cable Color Coding (Revision D, July 2014).
7. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
8. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
9. ANSI/TIA-758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard (Revision B, March 2012).
10. ANSI TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (Revision A, July 2015).
11. ANSI/TIA-526-14-C: Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant (Revision C, 2015).
12. ANSI/TIA-1152-A: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling (Revision A, November 2016).
13. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
14. Underwriter’s Laboratories, Inc. (UL).
15. Federal Communications Commission (FCC).
16. Americans with Disabilities Act (ADA).

17. Washoe County School District Structured Cabling System Standard WCSD-SCS-015 dated March 13, 2023, as referenced on the Project Drawings.

1.5 DEFINITIONS

A.	Accessible Ceiling	Space above a ceiling constructed of removable tiles (clipped or unclipped). Acoustical ceiling grid with removal tiles would be considered an accessible ceiling. A gypboard ceiling would not be considered an accessible ceiling.
B.	Approved/Approval	Written permission to use a material or system.
D.	As Called For	Materials, equipment including the execution specified/shown in the Specifications.
D.	Code Requirements	Minimum requirements.
E.	Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
F.	Exposed	Work not identified as concealed.
G.	Final Acceptance	Owner acceptance of the project from the Contractor upon certification by the Owner's Representative.
H	Furnish	Supply and deliver to installation location.
I.	Furnished by Others	Receive delivery at job site or where called for and install.
J.	Inspection	Visual observations by Owner or Owner's Representative.
K.	Install	Mount and connect equipment and associated materials ready for use.
L.	Listed	Refers to classification by a standards agency.
M.	Or Approved Equal	Approved equal or equivalent as determined by Owner or Owner's Representative.
N.	Owner's Representative	Design professional or Consultant representing the Owner.
O.	Provide	Furnish, install and connect ready for use.
P.	Relocate	Disassemble, disconnect, and transport equipment to new locations: then clean, test, and install ready for use.
Q.	Replace	Remove and provide new item.
R.	Review	A general contractual conformance check of specified products.

S. Satisfactory — As specified in Specifications.

1.6 INTENT OF DRAWINGS

A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner's Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy

B. Items mentioned in the Specifications and not shown in the Drawings, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner's Representative shall govern.

C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.

D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.7 REVIEW OF SPECIFICATIONS

A. The Contractor shall carefully study and compare the Drawings and Specifications. Any error, inconsistency or omission discovered shall be immediately reported to the Owner or Owner's Representative. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.

1.8 EXAMINATION OF THE PREMISES

A. The Contractor shall visit the Site to become familiar with the local conditions under which the work is to be performed and correlate the observations with the requirements of the Drawings and Specifications. No allowance will be made for claims of concealed conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.

B. Before ordering any materials or performing any work, the Contractor shall coordinate the installation with the work of other trades and shall verify all measurements. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.9 COORDINATION OF TELECOM CABLING PATHWAYS AND TELECOM EQUIPMENT ROOMS

A. The telecom drawings are diagrammatic in depicting the routing of communications pathways and the layout of communications equipment.

B. The contractor shall coordinate the installation of all telecom work with the work of other trades including Mechanical, Electrical, Plumbing, Sprinkler, Structural and Architectural.

C. The contractor shall participate in coordination meetings with other trades prior to the installation of the work. For a specific space/area, the telecom contractor shall coordinate the routing and installation of all telecom work with all other trades that have work in that specific space/area.

D. Prior to the installation of telecom cabling pathway including conduit, basket tray, cable tray, ladder rack, sleeves, etc., the contractor shall coordinate the routing of this pathway to avoid conflicts with and provide necessary clearances from the work of other trades. The contractor shall provide all horizontal offsets, vertical offsets and radius bends as necessary to coordinate the routing of the telecom pathway with the work of other trades and building structure.

E. Prior to the installation of equipment and/or cabling in the communication rooms, the contractor shall coordinate the layout of all equipment and cable pathways. The contractor shall submit shop drawings for approval of each room. At a minimum, the following information shall be included on the shop drawings:

1. Layout of all floor mounted equipment including racks, cabinets and uninterruptible power supplies. Drawings shall show the required clearances with dimensions in the front, rear and side of all floor and wall mounted equipment.
2. Layout of all floor mounted sleeves and cable openings.
3. Layout of horizontal and vertical ladder rack.
4. Layout of light fixtures, HVAC equipment and ductwork serving the room. Coordinate the layout of this equipment with the overhead cable pathways.
5. Provide elevations of each wall showing the location of all wall mounted equipment including racks, ground bars, electrical panels, electrical outlets, wall mounted termination equipment, cable slack storage rings, security panels, etc.

1.10 WARRANTY AND SERVICES

A. The installed Belden 10GX, 2400, and/or FiberExpress System shall be covered by a certification program provided by BELDEN/CDT and the Certified System Vendor (Contractor).

B. All Contractor-installed cabling shall be certified as per BELDEN/CDT requirements for the Belden 10GX, System 2400, and/or FiberExpress System. Any requirements for Belden Certification not specified within the Plans and Specifications but necessary for certification are assumed.

C. Lifetime Application Assurance

1. Belden certification shall provide the assurance that all present and future applications engineered for the performance level of the cabling system used shall work for the lifetime of the certified Belden 10GX, System 2400, and/or FiberExpress System.
2. Should the certified Belden 10GX, System 2400, or FiberExpress System fail to support the application(s) designed to operate over it—whether at the time of cutover to the new cabling system, during subsequent use, or after upgrading to a newer supported application (for example, to a Gigabit Ethernet or an ATM network from a lower-speed network environment)—BELDEN/CDT and The Certified System Vendor (Contractor) shall take prompt corrective action.

D. 25-Year Product Warranty

1. Belden certification shall provide a twenty-five (25) year product warranty for all Belden passive components used in the installed Belden 10GX, System 2400,

and/or FiberExpress System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. Electrical equipment and systems shall meet UL Standards and requirements of the National Electric Code. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the Specifications shall be performed in accordance with these requirements.

B. Equipment shall meet all applicable FCC Regulations.

C. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.

D. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or cataloged item of equipment. All equipment and systems must conform to the Specifications.

2.2 WORKMANSHIP, SUBSTITUTIONS, WARRANTY

A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for a minimum of one (1) year from the date of final acceptance. Cable integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed free from defects, transpositions, open shorts, tight kinks, damaged jacket insulation, etc.

B. Refer to the individual Division 27 Specifications for additional and/or extended warranty requirements.

C. All labor must be thoroughly competent, skilled and trained, and all work shall be executed in strict accordance with the best practice of the trades.

D. The Contractor shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, improper installation or poor workmanship.

E. After the Contract is awarded, requests to substitute for specified materials shall be submitted by the Contractor to the Owner or Owner’s Representative within thirty (30) days, complete with reasons for the substitution and savings which accrue to the Owner if the substitutions are approved. Substitutions after Contract award will be considered only if the substitutions are equal or superior to the products specified.

F. No material substitutions will be allowed except by written acceptance from the Consultant. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples are provided.

G. Approval of alternate or substitute equipment or material in no way voids the Specification requirements.

H. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submit to the Owner or Owner’s Representative all evidence to support the contention

that the item proposed for substitution is equal to the specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.

2.3 FACTORY ASSEMBLED PRODUCTS

A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit need not be products of the same manufacturer.
2. Component parts, which are alike, shall be from a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Components of equipment shall bear the manufacturer's name or trademark model number and serial number on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

B. Major items of equipment that serve the same function must be the same make and model.

C. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.

D. Maximum standardization of components shall be provided to reduce spare part requirements.

PART 3 – EXECUTION

3.1 ROUGH-IN

A. Before construction work commences, the Contractor shall visit the site and identify the exact routing of horizontal and backbone cable pathways.

B. All equipment locations and cabling pathway shall be coordinated with other trades and existing conditions to eliminate interference with required clearances for equipment maintenance and inspections.

C. Coordinate work with other trades and existing conditions to determine exact location of equipment and routing of cable pathways.

1. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. If, after installation of any equipment, piping, ducts, conduit, etc., it is determined that adequate space has not been provided for passage or maintenance, rearrange the work. Any changes in the size or location of the material or equipment supplied or proposed, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

D. Provide easy, safe and code mandated clearances at equipment racks and enclosures.

3.2 CUTTING, CORING AND PATCHING

A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the communications cabling pathway system.

B. Protect existing finishes from water damage during core/cutting work and cleanup all related water and debris. Patch adjacent work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.

C. Contractor to submit all proposed concrete wall or floor penetrations to the Structural Engineer for approval prior to performing the work. Contractor shall locate and avoid cutting concrete reinforcing steel using current x-ray or pachometer equipment.

3.3 FIRESTOPPING

A. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

B. Firestopping assemblies shall meet or exceed the rating of the wall or floor being penetrated.

C. Fire stopping References:

1. ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.
2. ASTM E 119, Fire Tests of Building Construction and Materials (for fire-rated architectural barriers).
3. 2023NFPA National Electrical Code, Spread of Fire and Products of Combustion.

3.4 CONCEALMENT

A. Telecom cabling pathways including conduit, sleeves and tray shall be concealed above ceilings, in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, or in areas without ceilings, the Owner’s Representative shall be notified of the proposed routing prior to starting that portion of the work.

B. All telecom cabling must be routed concealed above accessible ceilings or in conduit. No exposed telecom cabling is permitted with the exception of telecom cabling routed within the telecom rooms.

3.5 CONDUIT SEALING

A. All penetrations through slab-on-grade and concrete-filled metal decks to be sealed watertight. See Section 07 92 00 – Joint Sealants.

B. The Contractor shall seal all foundation penetrating conduits and all service entrance conduits and sleeves to eliminate the intrusion of moisture, gases and rodents into the building. This requirement also applies to spare conduits.

C. Spare conduits shall be plugged with expandable plugs.

D. All service entrance conduits shall be sealed or resealed after cable installation.

3.6 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

B. Where mounting heights are not dimensioned, install systems, materials and equipment to provide the maximum headroom possible.

C. Set all equipment to accurate line and grade, level all equipment and align all equipment components.

D. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises.

E. No equipment shall be hidden or covered up prior to inspection by the Owner's Representative. All work that is determined to be unsatisfactory shall be corrected immediately.

F. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

G. The Contractor shall replace all ceiling tiles damaged by work performed as part of the communications contract.

H. Storage and security of material and equipment shall be the responsibility of the Contractor.

END OF SECTION 270500

SECTION 270528 – INTERIOR COMMUNICATION PATHWAYS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete interior communication pathways and to ensure that the pathways are in compliance with requirements stated or reasonably inferred by this Specifications, and the Construction Drawings.

C. This section includes minimum requirements for communication pathways for horizontal and backbone cabling.

D. This section includes minimum requirements for the following

1. Conduit
2. Sleeves
3. Penetrations
4. Wire Cable Tray
5. Pull Boxes
6. Velcro Tie Wraps
7. Cable Hangers (J-Hooks)
8. Measuring Tape and Pull String
9. Innerduct
10. Fire Stop

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 11 00: Communications Equipment Room Fittings
3. 27 15 00: Communications Horizontal Cabling
4. 27 51 13: Paging Systems
5. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of 27 05 00 1.4 and in particular the following code requirements

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).

2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
4. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
5. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
6. Underwriter’s Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

A. All pathways and associated equipment shall be installed in a neat and workmanlike manner. Conduit, J-hooks, cable tray and pull boxes shall be installed and properly coordinated with other trades so that they are fully accessible for installation and pulling of cable. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative.

1.5 SUBMITTALS

A. The Contractor shall provide product manufacturers data sheets for the following Items

1. Cable Tray.
2. Velcro tie wraps.
3. Measuring tape / pull string.
4. Innerduct.
5. Firestop.

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

C. Shop drawings indicating the proposed layout and elevation of the following items shall be submitted for review and approval. Shop drawings shall be coordinated with the work of other trades.

1. Cable tray.
2. Conduit 2” and larger.
3. Pull boxes.
4. Main J-Hook runs.
5. Sleeves.

D. As-built drawings shall be submitted at the completion of the project showing the actual routing and location of the following items:

1. Cable Tray.
2. Conduit 2” and larger.
3. Pull boxes.
4. Sleeves
5. Main J-Hook runs.

PART 2 – PRODUCTS

2.1 CONDUITS

A. See Electrical Specifications for additional raceway and j-box products and additional requirements.

B. Install conduit where shown on the drawings.

C. All backbone fiber and copper telecom cabling shall be installed in conduit.

D. Conduit shall be routed concealed unless otherwise noted on the drawings.

E. Install conduit for routing of horizontal telecom cabling where cable is routed through inaccessible areas including but not limited to walls, floors, chases, above gypboard or plaster ceilings, etc. Provide access doors as required to provide reasonable access for the installation of telecom cabling in inaccessible ceiling and wall spaces.

F. Install conduit for routing of horizontal telecom cabling where cabling is routed in areas subsequent to damage including mechanical and electrical rooms.

G. Install ground bushing on the ends of conduit at telecommunication rooms. Install a #6 green insulated ground conductor from the ground bushing to the grounding bar in the telecommunication room.

H. At each wall or ceiling mounted telecom outlet, the contractor shall install a 4 11/16” wide by 4 11/16” high by 2 ½” deep box with 1” conduit (UON) to an accessible ceiling space. Where the conduit stubs into an accessible ceiling space, install a plastic bushing on the end of the conduit to prevent damage to the cable jacket.

I. Where conduit penetrations are exposed in finished areas, install steel, chrome plated split ring escutcheon plates.

J. At all exterior locations or in areas subject to damage, install rigid or IMC conduit. Exposed conduit shall be painted to match existing surfaces.

2.2 WIRE CABLE TRAY

A. Provide wire cable tray where shown on the drawings meeting the following specifications:

1. UL Classified.
2. 12” width x 4” depth, 18” width x 4” depth and 24” width x 4” depth. See plans for sizes.
3. Constructed of high strength steel wires formed into 2 inch by 4 inch wire mesh pattern.
4. Continuous welded construction.
5. Electroplated Zinc finish.

B. The wire cable tray routing shown on the drawings is diagrammatic. Prior to the installation of wire cable tray, the contractor shall coordinate the routing to avoid conflicts with and provide necessary clearances from the work of other trades. The contractor shall provide all horizontal offsets, vertical offsets and radius bends as necessary to coordinate the routing of the wire cable tray with the work of other trades and building structure.

C. The basket tray shall be designed of adequate strength to support the entire volume of the tray filled with horizontal 4-pair UTP communications cables.

D. Provide Manufacturer’s splice connections between all sections of tray. Provide quantity of splice connectors as required by the Manufacturer. Splice connectors shall provide a

continuous ground path for the tray in accordance with the NEC. All splicing assemblies shall be bolted with serrated flange lock nuts.

E. Provides “T” sections and radius bends in the basket tray at all perpendicular tray intersections.

F. Where wire cable trays penetrate non-rated walls, stop cable tray short of wall and provide smoke and acoustical pathways.

G. Where wire cable trays penetrate fire rated walls, stop cable tray short of wall and provide 4” conduit sleeves with a UL listed firestop assembly.

H. Provide grounding jumpers to bond discontinuous sections of the wire cable tray. At transitions between the cable tray and conduit/sleeves, install ground bushings on the conduit/sleeves and install a #6 ground wire to bond the cable tray to the conduit/sleeves.

I. Wire cable tray shall be supported using a trapeze system consisting of horizontal 1 5/8” Unistrut and two 3/8” threaded rods. Install “drop-in” anchors, wedge anchors and beam clamps to support the threaded rod from the building structure. Space supports per manufacturer’s requirements but not to exceed 8’-0” on center.

J. Provide Unistrut lateral and longitudinal bracing every 40’-0”, at 90 degree turns, and where required by local building codes. Provide rod stiffeners as necessary.

K. Installed wire cable tray shall have rounded edges and smooth surfaces to prevent damage to cable jackets.

L. Provide radius corners at all 90 degree bends, tees and crosses.

M. Acceptable products:

1. Cooper B-Line WB400 Series (WB412, WB418 and WB424 tray and associated connectors, splices, supports, etc).
2. Cablofil CF 105 series (CF 105/300, CF 105/450 and CF 105/600 tray and associated connectors, splices, supports, etc).
3. Chatsworth OnTrac Wire Mesh Cable Tray System (CPI P/N’s 34821-512, 34821-518 and 34821-524 and associated connectors, splices, supports, etc).
4. Or approved equal.

2.3 SLEEVES

A. Contractor shall provide sleeves as shown on the drawings and as required to route telecom cabling through floor, ceiling and wall penetrations.

B. Contractor shall provide size and quantity of sleeves so as not to exceed 20% fill ratio and to accommodate future telecom cabling.

C. Where wire cable trays penetrate fire rated walls, stop cable tray short of wall and provide 4” conduit sleeves with a UL listed firestop assembly.

D. See the Electrical Specifications for acceptable products and additional requirements.

E. Provide 4” vertical steel sleeves where shown on the drawings and to accommodate conduit or cable routing through floor slabs. Sleeves shall extend 6 inches above and below the floor slab and shall be cast into the concrete. Where sleeves are core drilled into the concrete, install firestopping material between the sleeve and the floor slab to

maintain the floor rating. Provide plastic or nylon bushings on both sides of sleeves to prevent damage to cabling.

F. Provide 4” horizontal sleeves where shown at telecom rooms or rated walls to accommodate routing of horizontal cabling from the corridors. Sleeves should extend 2” beyond the wall on both sides. Provide plastic or nylon bushings on both sides of sleeves to prevent damage to cabling.

G. Install split sleeves (not shown on the drawings) to accommodate routing of horizontal cabling through non-rated full height gypboard walls. Sleeves shall be sized so as not to exceed a 20% fill rate.

H. Provide separate sleeves for routing of CAT 6 and CAT 6A cabling.

I. Install firestopping between the sleeve and structure, and between the telecom cables and the sleeve to maintain the wall rating.

J. Where sleeve penetrations are exposed in an architectural finished area, install chrome plated steel split ring escutcheon plates.

2.4 PULL BOXES

A. See the Electrical Specifications for additional pull box requirements and acceptable manufacturers.

B. Provide pull boxes where shown on the drawings to accommodate copper backbone cable splices.

C. Provide pull boxes in backbone cabling conduit every 100 feet and every 180 degrees of bend (whichever is the more strict provision) to facilitate pulling of backbone cabling.

D. Pull boxes shall be sized so as not to exceed the minimum bend radius of the backbone fiber and copper cabling.

E. Coordinate location of pull boxes with other trades. Provide access doors where required to access pull boxes in inaccessible wall or ceiling spaces.

2.5 CABLE HANGERS (J-HOOKS) AND SUPPORTS

A. Provide cable hangers (J-hooks) spaced at 5’-0” centers to support horizontal cable from the workstation outlet to the cable tray.

B. Hangers shall be prefabricated, zinc coated, carbon steel hangers designed specifically for 4-pair UTP communications cabling installations.

C. Hangers shall have an open top and rolled edges. Hangers shall have a minimum 2” and maximum 4” diameter loop.

D. Hangers shall be supported directly from the building structure. The Contractor shall provide anchors, beam clamps, threaded rod, rod fasteners, flange clips and brackets as needed to support the cable hangers from the building structure. Do not attach hangers to ceiling support wires or other support systems installed by other building trades.

E. J-hooks shall not support more cables than recommended by the manufacturer. J-hooks shall be sized to provide a minimum 20 percent spare capacity.

F. Cable bundles shall not exceed (24) cables and shall be loosely bound with Velcro cable straps.

G. Acceptable Products

1. Erico Caddy CableCat Clips.
2. B-Line Cable Hook System.
3. Panduit J-Pro Cable Support System.
4. Or approved equal.

2.6 VELCRO CABLE STRAPS

A. Install Velcro cable ties cut to length from a continuous roll to loosely bundle horizontal cabling routed down J-hook lines, on the cable tray and ladder rack.

B. Install Velcro cable ties at 2’-0” intervals outside of the telecom room and 1’-0” intervals inside the telecom room.

C. Do not exceed qty (24) cables per bundle.

D. Provide plenum rated Velcro tie wraps where cable is routed in plenum spaces.

E. The use of plastic tie-wraps to bundle cabling is not permitted.

A. Acceptable Products
1. Panduit HLS-15R6 or HLSP (plenum rated).
2. Leviton 43115-075.
3. Or approved equal.

2.7 MEASURING TAPE AND PULL STRING

A. Install pull string in all telecom conduit and innerduct. Pull string shall be ½” pre-lubricated high strength woven polyester with sequential foot markings. The tensile strength of the pull string shall be greater than or equal to 1,250 lbs.

B. Pull string shall meet or exceed the requirements of Bellcore GR-356-CORE “Generic Requirements for Optical Cable Innerduct and Accessories”.

C. Acceptable Products

1. Carlon TL145xx.
2. A-D Technologies Bull-Line WP12xx.
3. Or approved equal.

2.8 INNERDUCT

A. Provide multi-cell fabric innerduct where shown on the drawings and for installation of backbone fiber and copper cabling.

B. Innerduct should be terminated at the conduit entrance in the telecom rooms and secured to the plywood backboard.

C. Provide fabric innerduct size and cell count as shown on the drawings.

D. Acceptable Products

1. Maxcell Fabric Innerduct
2. No Known Equal.

2.9 FIRE STOPPING

A. Provide fire stopping and backing material between sleeves/conduit penetrations through rated partitions or floors. Provide fire stopping in sleeves/conduits after all cables have been installed.

B. The minimum required fire resistance ratings of the wall of floor assembly shall be maintained by the fire stop system. The installation shall provide an air and watertight seal.

C. Fire stopping shall be listed or classified by an approved independent testing laboratory. The system shall meet the requirements of “Fire Tests of Through-Penetration Fire Stops” designated ASTM E814.

D. Manufacturer’s recommended installation standards shall be closely followed (i.e. minimum depth of material, use of ceramic fiber and installation procedures).

E. For each firestopping system on the project, submit the page from the UL fire resistance directory showing the firestopping system.

F. Acceptable Manufacturers:

1. 3M.
2. Hilti.
3. Nelson.
4. Specified Technology.
5. Or approved equal.

PART 3 – EXECUTION

3.1 COMMUNICATION PATHWAY SUPPORTS

A. All hangers for communication items (conduit, boxes, wire basket tray, j-hooks and all other related equipment) where an “Epic Deck” system occurs shall be compatible for use with this system, “Epic Deck” is by Epic Metals Corporation. See Architectural and Structural drawings for locations.

3.2 CONCEALMENT

A. Telecom cabling pathways including conduit, sleeves and cable tray shall be concealed above ceilings, in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, or in areas without ceilings, Contractor shall submit proposed routing of the raceway for review and approval prior to starting that portion of the work.

B. All telecom cabling must be routed concealed above accessible ceilings or in conduit. No exposed telecom cabling is permitted with the exception of telecom cabling routed within the telecom rooms.

3.3 COORDINATION DRAWINGS

A. The telecom drawings are diagrammatic in depicting the routing of telecom cabling pathways.

B. The contractor shall coordinate the installation of all telecom pathways with the work of other trades including Mechanical, Electrical, Plumbing, Sprinkler, Structural and Architectural.

C. The contractor shall participate in coordination meetings with other trades prior to the installation of telecom cabling pathways. For a specific space/area, the telecom contractor shall coordinate the routing of telecom pathways with all other trades that have work in that specific space/area.

D. Prior to the installation of telecom cabling pathway including conduit, basket tray, cable tray, ladder rack, sleeves, etc., the contractor shall coordinate the routing of this pathway to avoid conflicts with and provide necessary clearances from the work of other trades. The contractor shall provide all horizontal offsets, vertical offsets and radius bends as necessary to coordinate the routing of the telecom pathway with the work of other trades and building structure.

3.4 COMMUNICATION PATHWAYS

A. Prior to cable installation, the Contractor shall verify that the telecommunications pathways are installed as specified in the Drawings and Specifications. Any variations or violations from these documents shall be immediately reported to the Owner’s Representative. No portion of the Structured Cabling System shall be installed in any component of the Telecommunications Pathways and Spaces which deviates from these documents. All cabling designated on the Blueprints as terminating within a specific Telecom Room shall be installed as such unless otherwise specified in writing by the Owner’s Representative.

B. Cabling for other trades shall not occupy any pathway utilized for telecommunications cabling.

C. The cable tray shall be installed so that a minimum of 6” clear space is maintained above the top of the tray to facilitate cable installation. The contractor shall coordinate the routing of the cable tray with other trades so that plumbing piping, fire sprinkler piping, ductwork, conduits, etc are not routed within the 6” clear space above the tray.

D. Where the routing of telecom pathways conflicts with the work of other trades, the telecom contractor shall reroute the telecom pathway (cable tray, conduit, sleeves, etc.) as required to eliminate the conflict.

E. The drawings are diagrammatic and provide a general routing for conduit, J-hooks and cable tray. The Contractor shall coordinate the exact routing of the communication raceway systems with other trades and the building structure. Access doors shall be installed as necessary to provide access for cable installation, inspection and maintenance.

F. Install conduit where shown on the drawings or as required to route telecom cabling in inaccessible ceiling or wall spaces. Install conduit to protect cable where routed through areas subject to damage including mechanical and electrical rooms.

G. Cable pathways including conduit, cable tray, sleeves, and J-hooks shall be sized for 20% fill capacity.

H. When installing conduit, J-hooks and cable tray, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).

1. 6” clear from power conductors.
2. 12” clear from fluorescent lighting fixtures and ballasts.
3. 36” clear from transformers and motors.

I. Provide all items necessary for the support and seismic bracing of conduit and cable tray including concrete anchors, clamps, brackets, hanger rods, rod stiffeners, unistrut, splice plates, couplers, expansion joint assemblies, etc.

J. The conduit and cable tray system shall provide a continuous ground path per the National Electrical Code. Conduit and tray shall be bonded to ground at the telecom rooms. All sections of the backbone conduit and tray shall be mechanically fastened and bonding jumpers shall be installed as necessary to provide continuous ground path.

K. In order to maximize floor and wall space in the telecom rooms, all conduit must be stubbed into the room above the ladder rack UON. Conduits shall not be stubbed up through the floor slab unless specifically shown on the drawings.

3.5 SLEEVES

A. Install sleeves through walls and floors as required to route horizontal and backbone telecom cabling.

B. Provide sleeves for penetration of all gypboard walls. Layout wall penetrations as directed by the General Contractor and provide split sleeves to the framing contractor for installation.

C. Where wire cable trays penetrate non-rated walls, stop cable tray short of wall and provide smoke and acoustical pathways.

D. Where wire cable trays penetrate fire rated walls, stop cable tray short of wall and provide 4” conduit sleeves with a UL listed firestop assembly.

E. Firestop all penetrations through rated walls. Firestop assemblies shall meet or exceed the rating of the walls or floors being penetrated.

F. Coordinate layout and installation of concrete wall and floor sleeves prior to concrete pours. Contractor is responsible for providing, installing, securing and covering sleeves. The contractor shall have field personnel on site during concrete pours to ensure that sleeves are not dislodged or moved during concrete pours. Contractor will be responsible for core drilling costs related to missed or improperly located sleeves.

G. Where sleeves are installed more than 24” above the overhead ladder rack in the telecom rooms, install wall mounted vertical ladder rack below the sleeves to support cabling.

H. Provide separate sleeves for routing of CAT 6 and CAT 6A cabling.

3.6 CUTTING, CORING AND PATCHING

A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the telecommunications cabling pathway system.

B. Protect existing finishes from water damage during core/cutting work and cleanup all related water and debris. Patch adjacent work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.

C. Contractor to submit all proposed concrete wall or floor penetrations to the Structural Engineer for approval prior to performing the work. Contractor shall locate and avoid cutting concrete reinforcing steel using current x-ray or pachometer equipment.

3.7 CABLE HANGERS

A. Secure cable tray and J-hook hanger supports directly to the building structure. Hangers shall not be supported from the work of other trades including ceiling supports, electrical conduits, plumbing pipes, sprinkler piping, ductwork, ceiling mounted equipment or their supports unless it is part of an engineered system.

B. Install J-hooks on a maximum of 5’-0” centers. Install J-hooks a minimum of 6” above ceiling tiles to facilitate ceiling tile removal.

END OF SECTION 270528

SECTION 270800 – COMMISSIONING OF COMMUNICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the testing, labeling and documentation of the telecom cabling system in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

C. This section includes the minimum requirements for the testing, identification and administration for the telecommunications cabling system, including the following:

1. Testing

    a. Category 6 Cable Test Equipment and Test Procedures.
    b. Category 6A Cable Test Equipment and Test Procedures.
    c. Cable test reports.

2. Identification

    a. Labeling of work area outlet faceplates and jacks.
    b. Labeling of horizontal data, voice and video cabling.
    c. Labeling of Copper Patch Panels.

3. Administration

    a. As-built drawings.
    b. Materials listing.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 11 00: Communications Equipment Room Fittings
3. 27 15 00: Communications Horizontal Cabling
4. 27 51 13: Paging Systems
5. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of Specification Section 27 05 00 1.4 and in particular the following requirements

1. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
2. ANSI/TIA-568.3-D: Optical Fiber Cabling and Component Standard (Revision D, October 2016).
3. ANSI/TIA-598-D: Optical Fiber Cable Color Coding (Revision D, July 2014).
4. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
5. ANSI TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (Revision A, July 2015).
6. ANSI/TIA-526-14-C: Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant (Revision C, 2015).
7. ANSI/TIA-1152-A: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling (Revision A, November 2016).
8. ANSI/NFPA-70, 2023 -- National Electrical Code (NEC).
9. Underwriter's Laboratories, Inc. (UL).

1.4 SUBMITTALS

A. Test Equipment: Submit manufacturers' catalog sheets and specifications for the following cable testers

1. Category 6 cable tester.
2. Category 6A cable tester.

B. Calibration Reports: Provide calibration reports for all test equipment to be used on the Project. The calibration must have been performed by a manufacturer certified calibration facility and be dated no more than 60 days prior to the start of testing.

C. Cable Test Reports: Provide bound test reports for all cables signed by the technician performing the cable testing. Include Manufacturers data sheets for the cabling being tested.

D. Labels: Submit manufacturer's data sheets on the type of labels to be used for each labeling application.

PART 2 – PRODUCTS

2.1 HORIZONTAL CATEGORY 6 UNSHIELDED TWISTED-PAIR CABLE TESTER

A. Shall perform all tests necessary to certify the horizontal Category 6 UTP cabling in accordance with ANSI/TIA/EIA 568 B.2-1.

B. Shall be a UL certified Level III test set calibrated by a manufacturer certified calibration facility. The calibration shall be dated no more than 60 days prior to the start of testing.

C. Acceptable Manufacturers

1. Fluke Networks
2. Ideal Industries
3. Agilent Technologies
4. Or equal.

2.2 CATEGORY 6A (AUGMENTED) UNSHIELDED TWISTED-PAIR CABLE TESTER

A. Shall perform all tests necessary to certify the horizontal Category 6A UTP cabling in accordance with ANSI/TIA/EIA 568 B.2-1 and Category 6A standard ANSI/TIA/EIA–568-B.2-10 -- Augmented Category 6 Cable.

B. Shall be a UL certified Level IV test set calibrated by a manufacturer certified calibration facility. The calibration shall be dated no more than 60 days prior to the start of testing.

C. Acceptable Manufacturers

1. Fluke Networks
2. Ideal Industries
3. Agilent Technologies
4. Or equal.

2.3 LABELS

A. Labels shall be laser printed and shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Acceptable manufacturers

1. Belden
2. Brady
3. Brother
4. HellermannTyton.
5. Or approved equal

2.4 WORK AREA OUTLET FACEPLATE LABELS

A. Label each port in each faceplate in accordance with Labeling Scheme identified on the Drawings. Label must be machine printed and inserted in the faceplate label window. Labels shall be provided by the faceplate manufacturer of the faceplate.

B. Acceptable manufacturers

1. Belden
2. Brother
3. HellermannTyton.
4. No Substitution

2.5 HORIZONTAL CABLE SHEATH LABELS

A. Label horizontal cable sheaths at work area outlets and at patch panels with laser printed self-laminating wrap around vinyl labels. Labels shall be in accordance with the Labeling Scheme identified in WCSD SCS-015.

B. Labels shall be white with black type. Label size shall be 1.0” wide by 1.5” high.

C. At the Telecom Room, cable labels will be affixed to cable a minimum of 1 inch from the termination on the patch panel, and placed in such a way as to be clearly visible.

D. At the work area outlet, cable labels shall be affixed to the cable 2 inches from the termination on the jack.

1. Acceptable Manufacturers:

    a. Belden
    b. Brady
    c. Brother
    d. HellermannTyton.
    e. Or approved equal

2.6 COPPER PATCH PANEL LABELS.

A. Label each patch panel with a single panel ID label in accordance with the labeling scheme identified WCSD SCS-015.

B. Labels shall be compatible with the patch panels provided for the Project.

C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5” wide by 0.5” high.

1. Acceptable Manufacturers:

    a. Belden
    b. Brady
    c. Brother
    d. HellermannTyton.
    e. Or approved equal

D. Label each patch panel port with a laser printed label. Label each port with the room number of the room housing the work area outlet.

E. Labels shall be compatible with the patch panels provided for the Project.

F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.375” high.

1. Acceptable Manufacturers:

    a. Belden
    b. Brady
    c. Brother
    d. HellermannTyton.
    e. Or approved equal

    f.

PART 3 – EXECUTION

3.1 CABLE TESTING – GENERAL

A. Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.

B. Where post-manufacture test data has been provided by the manufacturer on the reel or shipping carton, submit copies to the Owner's Representative as part of the cable test results.

C. The Owner's Representative reserves the right to observe any or all portions of the cable testing process.

D. The Owner's Representative further reserves the right to conduct, using contractors equipment and labor, a random re-test of up to ten percent (10%) of the cable plant to confirm documented test results.

E. Test results and corrective procedures are to be documented and submitted to the Owner's Representative within five (5) working days of test completion.

3.2 CATEGORY 6 UTP CABLE TESTING

A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

B. Field test measurements shall be made in accordance with Annex I of ANSI/TIA/EIA-568-B.2 unless otherwise noted.

C. Field test measurements shall be conducted from 1 MHz to 250 MHz.

D. Field testing shall be conducted using a level III tester. The accuracy of the level III tester shall meet or exceed the requirements of Annex B of ANSI/TIA/EIA-568-B.2-1. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

E. Every cabling link shall be tested in accordance with the ANSI/TIA/EIA-568-B.1 Section 11.2: “100-Ohm twisted-pair transmission performance and field test requirements”.

F. The installed twisted-pair horizontal links shall be tested from the patch panel in the telecommunications room to the work area outlet. The cable must pass the “Permanent Link” performance limits specification as defined in ANSI/TIA/EIA-568-B.1.

G. 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned above. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

H. Trained technicians who have successfully attended an appropriate training program shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

I. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-B; Annex I: Section I.2.2).

J. The Contractor shall provide Category 6, 250 MHz channel test results on all pairs of cable. The following minimum field test parameters are required:

1. Wire map (including cable shield if present).
2. Length.
3. Insertion loss.
4. Near-end crosstalk (NEXT) loss.
5. Power sum near-end crosstalk (PSNEXT) loss.
6. Equal-level far-end crosstalk (ELFEXT).
7. Power-sum equal-level far-end crosstalk (PSELFEXT).
8. Return loss.
9. Propagation delay.
10. Delay skew.

K. Test results shall be provided in electronic format and printed 8.5” x 11” format signed by the technician performing the testing. The electronic format should be a Microsoft Word .doc file. Along with the above test parameters, the following information must be included for each cable tested:

1. Name of Owner and name of project (building name).
2. Date and time of test.
3. Name of technician performing the field testing.
4. Manufacturer, model number, serial number and software revision of field tester.
5. Cable ID (Telecom Room # - Patch Panel # - Port # / Work Area Room # - Telecom Outlet – Jack #).
6. Overall Pass/Fail result.
7. Manufacturer, category and model number of cable.
8. NVP used to determine cable length.

3.3 CATEGORY 6A (AUGMENTED) UTP CABLE TESTING

A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

B. Field test measurements shall be made in accordance with Annex I of ANSI/TIA/EIA-568-B.2 1 and the Category 6A standard ANSI/TIA/EIA–568-B.2-10.

C. Field test measurements shall be conducted from 1 MHz to 500 MHz.

D. Field testing shall be conducted using a level IV tester. The accuracy of the level IV tester shall meet or exceed the requirements of Annex B of ANSI/TIA/EIA-568-B.2-1 and the Category 6A standard ANSI/TIA/EIA–568-B.2-10. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

E. Every cabling link shall be tested in accordance with the ANSI/TIA/EIA-568-B.1 Section 11.2: “100-Ohm twisted-pair transmission performance and field test requirements”.

F. The installed twisted-pair horizontal links shall be tested from the patch panel in the telecommunications room to the work area outlet. The cable must pass the “Channel” performance limits specification as defined in ANSI/TIA/EIA-568-B.1.

G. 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned above. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

H. Trained technicians who have successfully attended an appropriate training program shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

I. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-B; Annex I: Section I.2.2).

J. The Contractor shall provide Category 6A, 500 MHz channel test results on all pairs of cable. The following minimum field test parameters are required:

1. Wire map (including cable shield if present).
2. Length.
3. Insertion loss.
4. Near-end crosstalk (NEXT) loss.
5. Power sum near-end crosstalk (PSNEXT) loss.
6. Equal-level far-end crosstalk (ELFEXT).
7. Power-sum equal-level far-end crosstalk (PSELFEXT).
8. Return loss.
9. Propagation delay.
10. Delay skew.

K. Testing and certification of the Category 6A cabling system for Alien Crosstalk IS REQUIRED as follows:

The Contractor shall perform Alien Crosstalk testing on 1% of the installed CAT 6A links. Testing shall be performed in accordance with Fluke Electronic's or Agilent Technologies' current White Paper specifying field Alien Crosstalk testing procedures. "Worst case" CAT 6A links shall be selected for the testing based on overall cable length and where the cable is routed adjacent to the largest number of cables.

L. Test results shall be provided in a CD-ROM format within 5 days after the completion of the project. Test documentation shall be saved in Fluke LinkWare file format version 2.2 or later and must include (along with the above test parameters), the following information:

1. Test results as downloaded from the tester. The following information shall be included in the test results:

   a. Record of test frequencies.
   b. Cable type.
   c. Conductor pair and cable I.D.
   d. Measurement direction.
   e. Reference setup.
   f. Crew member name(s).

2. Additional documentation required to provide the following (if not included in test results):

   a. Test equipment name, manufacturer, model number, serial number, software version and last calibration date.

b. The test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
c. Any required information not listed in test results (crew member, etc.).

3. The CD shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year).

4. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The Contractor must provide a copy of the last calibration certification with submitted test results.

5. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

3.4 CABLE TESTING VALIDATION

A. If requested by the Owner’s Representative, the Contractor shall participate in cable testing validation.

B. After the Contractor has completed all cable testing and submitted test results, the Contractor shall, in the presence of the Owner's Representative, test up to 5% of the installed and tested cables (random sample to be selected by the Owner's Representative).

3.5 IDENTIFICATION AND LABELING

A. The Contractor shall confirm the telecom room and work area room numbers with the Owner or Owner's Representative prior to labeling.

B. Labeling scheme shall follow the requirements of Washoe County School District Structured Cabling Specification WCSD-SCS-015 dated March 13, 2023.

C. Work Area Outlet Face Plates: See WCSD-SCS-015 for requirements.

D. Work Area Data and Voice Jacks: See WCSD-SCS-015 for requirements.

E. Work Area Horizontal Data, Voice and Video Cable: See WCSD-SCS-015 for requirements.

F. Telecom Room Horizontal Data, Voice and Video Cable: See WCSD-SCS-015 for requirements.

G. Patch Panels: See WCSD-SCS-015 for requirements.

H. Patch Panel Ports: See WCSD-SCS-015 for requirements.

I. Fiber Termination Cabinets: See WCSD-SCS-015 for requirements.

J. 110 Blocks: See WCSD-SCS-015 for requirements.

K. Backbone Cables: See WCSD-SCS-015 for requirements.

L. Equipment Racks and Cabinets: See WCSD-SCS-015 for requirements.

3.6 ADMINISTRATION

A. As-Built Drawings.

1. The Contractor shall provide As-Built drawings at the end of the project. One (1) reproducible and (1) blue line shall be provided. Electronic versions of the drawings in AutoCAD version 2000/2002 and PDF shall also be provided. The following information shall be provided on the As-Built Drawings:

a. Plan location of all telecom outlets.
b. Quantity and type of drops at each telecom outlet.
c. Telecom room where the drops are terminated.
d. Cable tray layout. Provide dimensions from building grid lines to locate cable tray.
e. J-hook layout. Provide dimensions from building grid lines to locate J-hook runs.
f. Conduits and pull box layout. Provide dimensions from building grid lines to locate conduits and pull boxes.
g. Backbone cable runs and pair/strand counts.
h. Horizontal and vertical sleeve layout.
i. Outside plant vaults and pull boxes. Provide dimensions from curbs to locate vaults and pull boxes.
j. Outside plant conduits. Provide dimensions from curbs to locate conduit.

B. Materials Listing

1. The contractor shall provide a spreadsheet indicating the materials and quantities used on the project. At a minimum, the spreadsheet will contain the following information: Item description, manufacturer, part number, quantity and color (where applicable).

END OF SECTION 270800

SECTION 271100 – COMMUNICATION EQUIPMENT ROOM FITTINGS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete communication equipment rooms and spaces, and to ensure that they are in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

C. Minimum requirements and installation methods are included for the following:

1. Horizontal Cable Managers
2. Category 5E Copper Patch Panels
3. Category 6 Copper Patch Panels
4. Category 6 Copper Patch Cords
5. Category 6A Copper Patch Panels
6. Category 6A (Augmented) Copper Patch Cords
7. Velcro Cable Ties

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 08 00: Commissioning of Communications
4. 27 15 00: Communications Horizontal Cabling
5. 27 51 13: Paging Systems
6. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of Specification Section 27 05 00 1.4 and in particular the following standards and code requirements.

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
4. ANSI/TIA-568.3-D: Optical Fiber Cabling and Component Standard (Revision D, October 2016).

5. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
6. ANSI/TIA-598-D: Optical Fiber Cable Color Coding (Revision D, July 2014).
7. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
8. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
9. ANSI/NFPA-70, 2023 - National Electrical Code (NEC).
10. Underwriter's Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

A. All cable, raceways and equipment in the telecom rooms shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative.

1.5 SUBMITTALS

A. Manufacturer's Data Sheets: Submit manufacturer's data sheets in electronic PDF format for the following items:

1. Horizontal Cable Managers
2. Category 5E Copper Patch Panels
3. Category 6 Copper Patch Panels
4. Category 6 Copper Patch Cords
5. Category 6A Copper Patch Panels
6. Category 6A (Augmented) Copper Patch Cords
7. Category 6 Entrance Terminals with Primary Protector Modules
8. Velcro Cable Ties

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

C. Shop Drawings: Submit shop drawings indicating the proposed layout of all telecom cabling pathways and equipment located in the telecommunication rooms, including coordinated rack elevations for existing and new rack-mounted equipment shown on the Contract Drawings. Shop drawings shall be coordinated with all trades having work in the telecom rooms. Shop drawings shall include the following items:

1. Plan view showing the layout of all floor mounted telecom and electrical equipment including cabinets, racks, UPS's and vertical cable management devices. Dimensions shall be provided showing required maintenance clearances in the front, rear and side of all equipment.
2. Plan view of all vertical floor sleeves and floor openings.
3. Plan view showing the layout of all cable pathway including horizontal ladder rack, horizontal basket tray, cable radius drop outs, vertical ladder rack and sleeves.
4. Plan view showing the location of all lighting fixtures, HVAC ductwork, fan coil units and/or split units serving the room. The contractor shall coordinate this work so that it does not conflict with the overhead cabling pathways or other telecom equipment.
5. Plan view showing the layout of all wall mounted equipment including ground bars, wall mounted racks, building entrance terminals, wall mounted termination fields, security panels, electrical panels, etc.
6. Wall elevations showing the layout and elevation of all wall mounted equipment.

1.6 DELIVERY, STORAGE & HANDLING

A. Protect all wiring blocks, patch panels, jacks and patch cords from moisture, dust and debris prior to installation.

B. Install equipment in the telecom rooms only after the room construction is complete and the room clean. This includes all gypboard walls, gypboard ceilings, floor finishes, t-bar grid, plywood backboards, door frames, doors and paint. Notify the Owner's Representative of any incomplete items prior to installing equipment.

1.7 GUARANTEE

A. See Specification Section 270500 1.10 for warranty requirements which apply to the patch panels and cabling specified in this section.

PART 2 – PRODUCTS

2.1 HORIZONTAL CABLE MANAGEMENT

A. Horizontal and vertical cable managers shall be provided from the same manufacturer and shall be compatible with the specified racks.

B. Horizontal cable managers shall be 2 rack units in height and have. See rack elevations for quantity.

C. All components shall be color black.

1. Acceptable Products:

a. Chatsworth P/N 11564-719 with slip on cover P/N 11764-719.
b. No Substitutions.

D.

2.2 CATEGORY 5E COPPER PATCH PANELS

A. Provide 19" rack mounted 48-port or 24-port Category 5E data patch panels as shown on the drawings.

B. Patch panels shall be constructed of black anodized aluminum or black powder coated steel.

C. Patch panels shall have fixed outlet jacks with 110 IDC connectors on the rear of the panel.

D. Patch panels shall be wired in accordance with the T568B standard.

E. The same manufacturer will be used for both the patch panels and workstation outlets throughout the Project.

F. Provide rear cable termination bracket with each patch panel.

G. Patch panels shall conform to ANSI/TIA/EIA–568-A Addendum 5 as shown below.

Parameter	Worst Case Channel Performance at 100MHz
Specified Frequency Range	1-100 MHz
Attenuation	0.4 dB
NEXT	43.0 dB
Return Loss	20.0 dB

H. Acceptable Products:

1. Belden/CDT P/N AX103258 (24-port), AX103259 (48-port). Provide cable tie-bar for each patch panel AX101173.
2. No Substitutions.

2.3 CATEGORY 5E COPPER PATCH CORDS FOR BACKBONE VOICE CABLING.

A. For every installed 25-pair CAT 5E backbone cable, provide qty (4) 7'-0" Category 5E patch cords with blue jackets

B. Acceptable Products:

1. Belden/CDT P/N C501106007.
2. No Substitutions.

2.4 CATEGORY 6A (AUGMENTED) COPPER DATA PATCH PANELS

A. Patch Panels shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

1. Provide 19” rack mounted 48-port Category 6A data patch panels as shown on the drawings. Category 6 field device cabling for surveillance, audio enhancement, and paging systems shall terminate on Category 6A RevConnect patch panels where indicated in the cable and termination schedule.

B. Patch Panels shall be 100% pre-loaded with CAT 6A modules.

C. Each patch panel CAT 6A module shall be provided with a color coded icon insert to designate its relationship to the following systems:

1. Data Port: Icon Insert – No icon insert required.
2. Wireless Access Point Port: Icon Insert color “White”.
3. CCTV System: Icon insert color “Black”.
4. Audio Enhancement System: Icon insert color “Gray”.
5. Paging System: Icon insert color “Green”.

D. Patch panels shall conform to the performance requirements of ANSI/TIA/EIA–568-B.2-10 for Augmented Category 6 Cable as outlined below.

Frequency (MHz)	NEXT (dB) (min.)	PSANEXT (dB) (min.)	RETURN LOSS (dB) (min.)
0.772	96.2	112.2	70.2
1	94.0	110.0	68
4	82.0	98.0	56
8	75.9	91.9	49.9

10	74.0	90.0	48.0
16	69.9	85.9	43.9
20	68.0	84.0	42.0
25	66.0	82.0	40.0
31.25	64.1	80.1	38.1
62.5	58.1	74.1	32.1
100	54.0	70.0	28.0
200	48.0	64.0	22.0
250	46.0	62.0	20.0
300	44.5	60.5	18.5
350	43.1	59.1	17.1
400	42.0	58.0	16.0
450	40.9	56.9	114.9
500	40.0	56.0	14.0
550	39.2	55.2	13.2
600	38.4	54.4	12.4
625	38.1	54.1	12.1

E. Acceptable Products:

1. 48-Port Cat 6A Patch Panels:

   a. Belden/CDT RevConnect P/N RVAPPF2U48BK.
   b. No Substitutions.

2. Colored Icon Inserts:

   a. Belden/CDT RevConnect P/N RVUICxx-B24 (provide icon insert colors for different systems as indicated above).
   b. No Substitutions.

2.5 CATEGORY 6 COPPER PATCH CORDS

A. Patch cords shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Provide Category 6 UTP patch cords for interconnection of owner furnished switches and patch panels in all IDF’s and the MDF.

1. Provide one (1) 4’-0” CAT 6 patch cord for each data drop or device connection related to the following systems, coordinated with the cable and termination schedule and system diagrams:
2.
3. CCTV System: Patch Cord Color “Black”.
4. Audio Enhancement System: Patch Cord Color “Gray”.
5. Paging System: Patch Cord Color “Green”.

C. Cabling used for patch cords shall be manufactured by the same manufacturer as the horizontal cabling and shall be of the same product line. Cable shall conform to the requirements of ANSI/TIA/EIA–568-B.2 Addendum 1. Electrical characteristics and performance of the patch cables shall be nearly identical to the horizontal cable with

exceptions given due to differences between solid and stranded conductors as indicated in the following table.

Frequency (MHz)	Stranded Conductor Cable Insertion Loss (dB)
1	2.4
4	4.5
8	6.4
10	7.1
16	9.1
20	10.2
25	11.4
31.25	12.8
62.5	18.5
100	23.8
200	34.8
250	39.4

D. Patch cords shall be rated for use as communications cable and shall have the designation “CM” or “CMR” printed on the jacket.

E. Acceptable Products:

1. Belden/CDT GigaFlex PS6+ Modular Cord P/N C60110xxxx (provide patch cord jacket colors for different systems as indicated above).
2. No Substitutions.

2.6 CATEGORY 6A (AUGMENTED) PATCH CORDS

A. Patch cords shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Provide Category 6A patch cords for interconnection of owner furnished switches and patch panels in all IDF’s and the MDF. Provide one (1) 4’-0” CAT 6A patch cord for each data drop related to the following systems:

1. Telecom Outlet: Patch Cord Color “Yellow”.
2. Wireless Access Point: Patch Cord Color “White”.

C. Provide Category 6A “work-area” patch cords for interconnection of owner furnished workstations and phones at the work-area outlets. Provide one (1) 15’-0” CAT 6A patch cord for each data drop related to the following systems:

3. Telecom Outlet: Work-Area” Patch Cord Color “Yellow”.

D. Patch cords shall be 4-pair, Category 6A unshielded twisted pair with solid conductors. Patch cords shall be manufactured by the same manufacturer of the horizontal cabling.

E. Physical Characteristics:

1. Category 6A cable shall meet or exceed the requirements of ANSI/TIA/EIA–568-B.2-10 -- for Augmented Category 6 Cable.

2. Cable shall have a listed riser rated jacket (CMR).

3. Cables shall be constructed of 4-pair, 23 AWG solid copper conductors.

4. The cable jacket must have the following legible markings

   a. Manufacturer's name.
   b. Copper conductor gauge.
   c. Pair count.
   d. UL and CSA listing.
   e. Manufacturer's trademark.
   f. Category rating.
   g. Jacket rating (CMR).

F. Acceptable Products:

1. Belden/CDT CA21104004 (4'-0" data drop patch cord - color yellow), CA21109004 (4'-0" WAP drop patch cord - color white), CA21104015 (15'-0" data drop "work-area" patch cord – color yellow).
2. No substitutions.

   a.

2.2 VELCRO CABLE TIES

A. Provide Velcro cable ties cut to length from a continuous roll to loosely bundle horizontal cabling in the telecom rooms routed on the ladder rack to the patch panels. Install Velcro cable ties at 1'-0" intervals.

B. Do not exceed qty (24) cables per bundle.

C. Do not attach cable bundles to the runway with the Velcro cable ties. Do not use plastic tie-wraps.

D. Acceptable Products

1. Panduit HLS-15R6.
2. Leviton 43115-075.
3. Or approved equal.

PART 3 – EXECUTION

3.1 TELECOM EQUIPMENT ROOM COORDINATION

A. The electrical and telecom contractors are responsible for coordinating the installation of all equipment and cabling pathways located within the telecom rooms.

B. The electrical and telecom contractors shall coordinate the work of all other trades that have work located within the telecom equipment rooms.

C. The electrical and telecom contractors shall create and submit for approval coordinated scaled shop drawings of the telecom room showing the proposed location of all work. Shop drawings shall be submitted and approved prior to installing any work in the telecom rooms.

3.2 HORIZONTAL CABLE PATHWAY

A. Should vertical or horizontal clearances not be possible due to physical constraints of the designated space, the Contractor shall immediately contact the Owner's Representative for alternative routing. Where the drawings indicate reuse of existing junction boxes, conduits, or pathway segments, verify existing pathway condition, capacity, continuity, and routing prior to use and maintain all specified bend radius, fill, pull-box, firestopping, grounding, and accessibility requirements.

B. Coordinate routing of cable pathway with lighting and HVAC serving the room. Secure cable pathway to walls, overhead structure and or equipment racks/cabinets as required.

C. Bond cable pathway sections together with #6 green insulated bonding jumpers. Bond pathway to telecom room ground bar with #6 green insulated conductor.

3.3 CABLE MANAGEMENT

A. Neatly bundle cabling with Velcro tie wraps on the horizontal ladder rack. Space Velcro tie wraps at 1'-0" on center.

B. Do not exceed qty (24) cables per bundle.

C. Neatly dress horizontal cable from the horizontal ladder rack, through the rear vertical cable managers to the rear of the patch panels. Use Velcro cable ties as necessary to maintain cable bundles. Do not exceed the manufacturer's cable bend radius.

D. Do not install cable ties to bundle patch cables.

3.4 PATCH PANELS

A. Terminate and dress cables on the rear of the patch panels in accordance with manufacturer instructions using the provided rear cable management bar or bracket.

B. Maintain cable twists within ½" of the patch panel IDC blocks.

END OF SECTION 271100

SECTION 271500 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the horizontal cabling system, and to ensure that it is in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

B. The horizontal cabling is that portion of the communication cabling system that extends from the work area communications outlets to the patch panels in the communications rooms.

C. This section includes minimum requirements for the following

1. Horizontal Category 6 Cabling.
2. Horizontal Category 6A (Augmented) Cabling.
3. CAT 6A Patch Cords.
4. Category 6A 8-Position Jacks.
5. Category 6A Field Mount Plugs
6. Work Area 4-Port Plastic Faceplates
7. Work Area 4-Port Stainless Steel Faceplates
8. Velcro Cable Straps

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 08 00: Commissioning of Communications
4. 27 11 00: Communications Equipment Room Fittings
5. 27 51 13: Paging Systems
6. 27 53 13: Wireless Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with Specification Section 27 05 00, the Contract Drawings, Washoe County School District Structured Cabling System Standard WCSD-SCS-015 dated March 13, 2023, and the following code and industry requirements.

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).

3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
4. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
5. ANSI/TIA-1152-A: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling (Revision A, November 2016).
6. Underwriter's Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

A. All materials shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specification shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and the manufacturer indicated. The equipment specified is based upon the acceptable manufacturers listed.

B. The Contractor shall strictly adhere to all Category 6 and Category 6A installation practices when installing unshielded twisted-pair cabling.

1.5 SUBMITTALS

A. Manufacturer's Data Sheets: Submit manufacturers data sheets for the following items

1. Horizontal Category 6 Cabling.
2. Horizontal Category 6A (Augmented) Cabling.
3. Category 6A 8-Position Jacks.
4. Category 6A Field Mount Plugs
5. Work Area 4-Port Plastic Faceplates
6. Work Area 4-Port Stainless Steel Faceplates
7. Velcro Cable Straps

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

1.6 DELIVERY, STORAGE & HANDLING

A. Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.7 GUARANTEE

A. The Category 6 and 6A horizontal cabling system including work area jacks, horizontal cabling, patch panels and patch cords shall be covered by a minimum 25-year system warranty from Belden/CDT (see section 270500 1.10 for warranty requirements).

PART 2 – PRODUCTS

2.1 HORIZONTAL CATEGORY 6 CABLE

A. Horizontal cabling shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Horizontal cabling shall be 4-pair, Category 6 unshielded twisted pair.

1. Physical Characteristics

   a. Category 6 cable shall meet or exceed the requirements of ANSI/TIA-568.2-D for balanced twisted-pair telecommunications cabling and components.

2. Cable shall have a listed plenum rated jacket (CMP).

3. The cable jacket must have the following legible markings

   a. Manufacturer's name.
   b. Copper conductor gauge.
   c. Pair count.
   d. UL and CSA listing.
   e. Manufacturer's trademark.
   f. Category rating.
   g. Sequential foot markings, in one foot increments.
   h. Jacket rating (CMP).

4. Horizontal data cable shall have a GRAY jacket with black lettering.

C. Transmission Characteristics

1. Cable shall conform to ANSI/TIA-568.2-D and shall be certified as Category 6 Permanent Link or Channel as applicable to the installed configuration.

Frequency (MHz)	Solid Conductor Cable Insertion Loss (dB)	NEXT Loss (dB)	PSNEXT Loss (dB)	ELFEXT Loss (dB)	Power Sum ELFEXT (dB)	Return Loss (dB)
1	2.0	74.3	72.3	67.8	64.8	20.0
4	3.8	65.3	63.3	55.8	52.8	23.0
8	5.3	60.8	58.8	49.7	46.7	24.5
10	6.0	59.3	57.3	47.8	44.8	25.0
16	7.6	56.2	54.2	43.7	40.7	25.0
20	8.5	54.8	52.8	41.8	38.8	25.0
25	9.5	53.3	51.3	39.8	36.8	24.3
31.25	10.7	51.9	49.9	37.9	34.9	23.6
62.5	15.4	47.4	45.4	31.9	28.9	21.5
100	19.8	44.3	42.3	27.8	24.8	20.1
200	29.0	39.8	37.8	21.8	18.8	18.0
250	32.8	38.3	36.3	19.8	16.8	17.3

2. Propagation delay skew shall not exceed 45 ns per 100 meters for all frequencies from 1 MHz to 250 MHz.

D. Acceptable Products:

1. Belden/CDT Gigaflex 2400 P/N 2413 08U1000 (jacket color gray).
2. No Substitutions.

2.2 CATEGORY 6A (AUGMENTED) HORIZONTAL CABLE

A. CAT 6A Horizontal cabling shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Horizontal data cabling for standard telecom outlets and wireless access points shall be 4-pair, Category 6A unshielded twisted pair.

C. Physical Characteristics

1. Category 6A cable shall meet or exceed the requirements of ANSI/TIA-568.2-D for Category 6A balanced twisted-pair telecommunications cabling and components.

2. Cable shall have a listed plenum rated jacket (CMP).

3. Cables shall be constructed of 4-pair, 23 AWG solid copper conductors.

4. The cable jacket must have the following legible markings

a. Manufacturer’s name.
b. Copper conductor gauge.
c. Pair count.
d. UL and CSA listing.
e. Manufacturer’s trademark.
f. Category rating.
g. Sequential foot markings, in one foot increments.
h. Jacket rating (CMP).

5. Horizontal data cable shall have a YELLOW jacket with black lettering.

D. Transmission Characteristics

1. Cable shall conform to ANSI/TIA-568.2-D and shall be certified as Category 6A Permanent Link or Channel as applicable to the installed configuration.

Frequency (MHz)	NEXT (dB) (min.)	PSANEXT (dB) (min.)	RETURN LOSS (dB) (min.)
0.772	96.2	112.2	70.2
1	94.0	110.0	68.0
4	82.0	98.0	56.0
8	75.9	91.9	49.9
10	74.0	90.0	48.0
16	69.9	85.9	43.9
20	68.0	84.0	42.0
25	66.0	82.0	40.0
31.25	64.1	80.1	38.1
62.5	58.1	74.1	32.1
100	54.0	70.0	28.0
200	48.0	64.0	22.0
250	46.0	62.0	20.0
300	44.5	60.5	18.5

350	43.1	59.1	17.1
400	42.0	58.0	16.0
450	40.9	56.9	14.9
500	40.0	56.0	14.0
550	39.2	55.2	13.2
600	38.4	54.4	12.4
625	38.1	54.1	12.1

2. Propagation delay skew shall not exceed 35 ns per 100 meters for all frequencies from 1 MHz to 625 MHz.

E. Acceptable Products.

1. Belden 10GXS CAT 6A Cabling. Belden/CDT Part Number 10GXS13 0041000 (jacket color yellow).
2. No Substitutions.

2.3 CATEGORY 6A FIELD MOUNT PLUGS

A. Field mount plugs shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Terminate CAT 6 cabling at all device locations for the following systems on CAT 6A field mount plugs and connect directly to the device.

1. CCTV System.
2. Audio Enhancement System.
3. Paging System.
4. Access Control System rough-in only, where specifically indicated on the Contract Drawings. Active access control devices, panels, readers, software, programming, and final system commissioning are not included in this Section unless expressly shown otherwise.

C. Terminate CAT 6A cabling at all device locations for the following systems on CAT 6A field mount plugs and connect directly to the device.

1. Wireless Access Points.

D. Field mount plugs shall be 8-pin Category 6A and will conform to the requirements of ANSI/TIA/EIA–568-B.2-10.

E. Pin/Pair assignment shall be in accordance with T568B.

F. Acceptable Products:

1. Belden/CDT RevConnect P/N RVAFPUBK-S1.
2. No Substitutions.

2.4 CATEGORY 6A MODULAR JACKS

A. CAT 6A modular jacks shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Modular jacks shall be 8-pin Category 6A and will conform to the requirements of ANSI/TIA/EIA–568-B.2-10.

C. Pin/Pair assignment shall be in accordance with T568B.

D. Modular jacks shall be manufactured by the same manufacturer as the patch panels in the telecommunication rooms.

E. Modular data jacks shall be color YELLOW.

F. Modular jacks shall be compatible with plastic faceplates and stainless steel faceplates.

G. Modular jacks shall be “Keystone” style.

H. Transmission characteristics for a mated-connection (jack and cord) shall conform to ANSI/TIA/EIA–568-B.2-10 as shown below.

Frequency (MHz)	NEXT (dB) (min.)	PSANEXT (dB) (min.)	RETURN LOSS (dB) (min.)
0.772	96.2	112.2	70.2
1	94.0	110.0	68.0
4	82.0	98.0	56.0
8	75.9	91.9	49.9
10	74.0	90.0	48.0
16	69.9	85.9	43.9
20	68.0	84.0	42.0
25	66.0	82.0	40.0
31.25	64.1	80.1	38.1
62.5	58.1	74.1	32.1
100	54.0	70.0	28.0
200	48.0	64.0	22.0
250	46.0	62.0	20.0
300	44.5	60.5	18.5
350	43.1	59.1	17.1
400	42.0	58.0	16.0
450	40.9	56.9	14.9
500	40.0	56.0	14.0
550	39.2	55.2	13.2
600	38.4	54.4	12.4
625	38.1	54.1	12.1

I. Acceptable Products:

1. Belden/CDT 10GX RevConnect Jacks P/N RVAMJKUYL-S1.
2. No Substitutions.

2.5 WORK AREA 4-PORT PLASTIC FACEPLATES

A. Faceplates shall meet the specific manufacturer system warranty requirements listed in Specification Section 270500 1.10.

B. Provide UL listed faceplates. Faceplates should be white (verify with Architect), flush mounted and manufactured of high impact thermoplastic.

C. Faceplates shall have top and bottom label holders with plastic inserts.

D. Provide faceplates with a minimum of 4 and a maximum of 6 modules. Provide blank inserts in unused openings.

E. Faceplates shall accept “Keystone” style modular jacks.

F. Faceplates shall be manufactured by the same manufacturer as the outlet jacks and shall be compatible with the submitted outlet jacks.

G. Acceptable Products:

1. Belden/CDT 4-Port Faceplate P/N AX102249 (color white) – verify color w/Architect.
2. No Substitutions.

2.6 WORK AREA 4-PORT STAINLESS STEEL FACEPLATES

A. Provide UL listed stainless steel faceplates at workstation outlets in the multipurpose room and where shown on the drawings.

B. Provide 4-port faceplates. Provide blank inserts in unused openings.

C. Faceplates shall accept “Keystone” style modular jacks.

D. Faceplates shall be manufactured by the same manufacturer as the outlet jacks and shall be compatible with the submitted outlet jacks. Provide “keystone” jacks as necessary.

E. Acceptable Products:

1. Stainless SG Faceplate. Belden/CDT AX102009.
2. No Substitutions.

2.7 VELCRO CABLE STRAPS

A. Loosely bundle horizontal cabling with Velcro tie wraps.

B. Velcro tie wraps shall ¾” in width and cut from a continuous roll.

C. Install Velcro cable ties at 2’-0” intervals outside of the telecom rooms and 1’-0” intervals inside the telecom rooms.

D. Do not exceed qty (24) cables per bundle.

E. Acceptable Products

1. Panduit TAK-TY HLSP (plenum).
2. Leviton 43115-075.
3. Or equal.

PART 3 – EXECUTION

3.1 HORIZONTAL CABLE ROUTING AND TERMINATION

A. Horizontal CAT 6 and CAT 6A cable routed in underground, under-slab, exterior, wet, or damp conduit shall be indoor/outdoor rated and suitable for wet locations while maintaining the required plenum or riser listing for the installed pathway.

B. Ten feet of cable slack shall be stored at the telecom room and three feet of cable slack shall be provided in the ceiling space above the telecom outlet for every installed horizontal cable.

C. All horizontal cables shall be installed in cable bundles. Cable bundles shall not exceed qty (24) cables per bundle and will be loosely bound with velcro straps. Cables in a bundle should be uncombed until entry into each rack's vertical cable management, where the cables are to be combed and dressed together until terminated on each patch panel.

D. Category 6 and Category 6A cables shall be bundled separately.

E. Cables shall be installed in continuous lengths from origin to destination with no splices unless explicitly shown on the Contract Drawings. Transition points, consolidation points or couplers shall not be used unless specifically detailed and approved by the Owner's Representative.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturers requirements and reference documents.

G. All telecom cables shall be supported by approved telecom pathways having dedicated support systems directly attached to structure (i.e. conduit, j-hooks, cable tray, etc.). Cables shall not be attached to or supported by ceiling grid, ceiling grid support wires, lighting fixture support wires or the work of other mechanical, electrical, plumbing or sprinkler trades.

H. All telecom cables shall be stored in accordance with the manufacturer’s requirements.

I. Any cable damaged or exceeding the manufacturer’s recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

J. All telecom cables shall be labeled with self-adhesive labels. At the work area outlet, the cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate. At the Telecom Room, each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cable labels located within the bundle or where obscured from view shall not be acceptable.

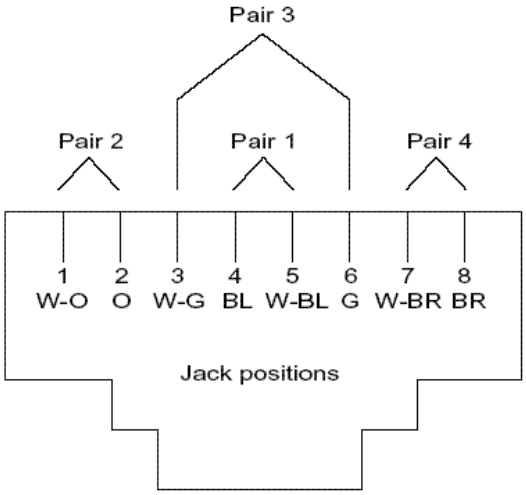
K. Cables shall be installed in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer’s recommendations and installation guides, and best industry practices.

L. Cables shall be installed in accordance with ANSI/TIA-568.0-E, ANSI/TIA-568.1-E, ANSI/TIA-568.2-D, manufacturer recommendations and installation guides, WCSD-SCS-015, and best industry practices.Plastic “zip-ties” shall not be permitted within the Structured Cabling System. “Velcro” type (hook and loop) tie wraps shall be used for the purpose of bundling / managing horizontal and backbone cabling (must be plenum rated if installed within a plenum space).

M. Horizontal UTP pair untwist at the termination shall not exceed 0.5”.

N. Jack pin/pair assignments shall be T568B for all installed horizontal cabling unless otherwise specified within the Project Documents.

1. T568B Jack pin/pair assignments are as follows:



O. For horizontal cabling, if a J-hook System is used to support cable bundles, all horizontal cables shall be supported at a maximum of 60” intervals. J-hooks must be secured to the permanent building structure. J-Hooks shall not be attached to ceiling tiles, ceiling grid, ceiling support wires or to the work of other mechanical, electrical, plumbing and sprinkler trades.

P. The horizontal telecom pathway and pathway support system shall not permit significant lateral or vertical motion. Cable quantities shall not exceed J-Hook System manufacturer recommendations or qty (24) cables, whichever is fewer.

Q. Telecom cables may not rest on acoustic ceiling grids or panels, or be attached to any portion of the building except for dedicated telecom pathway including conduit, innerduct, ladder rack, cable tray and/or J-hooks.

R. The cable length between the work area outlet and the termination in the telecommunications closet shall not exceed 295 feet. Any horizontal cable runs longer than 295 feet should be brought to the immediate attention of the Owner's Representative prior to installation.

S. When placing cable, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).

1. 6” clear from power conductors.
2. 12” clear from fluorescent lighting fixtures and ballasts.
3. 36” clear from transformers and motors.

3.2 WORK AREA OUTLETS

A. Work Area outlets and connectors shall be installed in accordance with manufacturer’s recommendations and installation guides, and best industry practices.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer's recommendations and best industry practices.

C. Pair untwist at the termination shall not exceed 0.5".

D. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.

END OF SECTION 271500

SECTION 275113 – PAGING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY OF WORK

A. This section includes a fully operational IP platform for a district-wide internal and school Critical Communications Solution, incorporating school safety notifications and general communications including but not limited to the following:

1. The platform shall provide complete internal communications and employ state of the art IP Technology including the minimum functions listed.

   a. Two-way internal intercommunications between staff locations and classrooms.
   b. Scheduled bell events.
   c. Emergency announcements that will override any pre-programmed audio, assuring that all Emergency/Lockdown etc., are heard at each and every speaker location.
   d. Capability of prerecording emergency announcements that can be activated by a Soft Key on an administrative console, panic button, dial string, or web browser.
   e. Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone.
   f. District-wide, Emergency, Group, All School and Zone live voice paging.
   g. District-wide, Emergency, Group, All School and Zone paging for pre-recorded audio – tones, music and voice.
   h. Web-based user interface.
   i. “Code Red” push button to initiate pre-recorded lock down announcement.
   j. Status indicator lights adjacent to all clocks (flush j-box, blank cover plate and conduit roughin only – status lights and cabling are future).

2. The system shall support a minimum of 1000 level priorities which shall be user-definable, allowing each end point to place a minimum of 5 different priority calls at the same time.
3. Any authorized administrator shall be able to call from outside the school into any classroom, zone, or entire school directly via the School District supplied SIP enabled Telephone Network. This shall allow remote monitoring, call-in annunciation, and two-way conversation from outside the facility as well as paging into the system. (Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools).
4. Authorized system users shall be able to create a minimum of 100 automated sequences with voice instructions, tones, emails, program distribution, and relay activations and replay them.

5. Automated message strings shall be manually initiated from a single-button access on the console, on a SIP connected telephone, a panic button, from the web-based user interface or via interface with third party systems.
6. Paging and two-way intercom features shall be accessible from any system console or SIP connected telephone for each campus.
7. The platform shall synchronize its system time to the network timeserver or a web-based time server.
8. Each single campus installation shall be locally survivable for intercom, paging, bells, and emergencies such as lockdown, even when the district connection is unavailable.
9. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.
10. Systems that do not comply with the feature-sets highlighted in this Specification will not be considered.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 08 00: Commissioning of Communications
4. 27 11 00: Communications Equipment Room Fittings
5. 27 15 00: Communications Horizontal Cabling
6. 27 41 16: AV and Safety Alert Systems
7. 27 53 13: Synchronized Clock Systems

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 DEFINITION OF TERMS

A. Installer(s): Shall refer to the person, persons, or company who or which actually contracts to perform the work specified herein.

1.4 SUBMITTALS

A. Product data for each component.

B. Shop Drawings: Prior to proceeding with the work: Provide detailed equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, location of each field connection, and a complete schedule of all equipment and materials with associated manufacturer’s product data sheets which are to be used.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components and levels throughout system and impedances.
2. Drawings and lists indicating proposed nameplate nomenclature and arrangements for control panels and plug panels prior to fabrication reflecting equipment used.
3. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled. All drawings shall have the name and locations of the project, Systems Contractor's name in the title block.
4. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment, furnished.

C. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems, which are not FCC approved or utilize an intermediary device for connection, will not be considered. Provide the FCC registration number of the system being proposed as part of the submittal process.

D. Product Certificates: Signed by manufacturers certifying that products furnished comply with specified requirements.

E. Installer Certificates: Signed by manufacturers certifying that Installers comply with specified requirements.

F. Manufacturer Certificates: Signed by manufacturers certifying that they comply with specified requirements.

G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

H. Maintenance Data: For equipment to be included in maintenance manuals specified in Division 1.

1. Record of Owners equipment-programming option decisions.
2. All instructions necessary for proper operation and manufacturer's instructions.
3. "Proof of Performance" information.
4. Manufacturer's maintenance information.
5. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.

I. As-Built Drawings: Prior to final acceptance, provide as-built drawings in PDF format indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing".

J. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and in accordance with Division 1 specifications.

1. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner's representative.
2. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
3. Include with the submittal a current copy of trainer's needs assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.
4. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.

K. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section. Provide the following within thirty (30) days after notification to proceed:

1. Provide a list of installations that the Installer has specifically installed for verification by the Owner. Random installations from other vendors and/or Installers shall not be accepted. The Installer, not its employees, must meet these qualifications.
2. The Installer shall be bondable.
3. The Installer shall demonstrate to the satisfaction of the Owner or his representative that he has:

    a. Adequate plant and equipment to pursue the work properly and expeditiously.
    b. Adequate staff and technical experience to implement the work.
    c. Suitable financial status to meet the obligations of the work.
    d. Technically capable and factory trained service personnel at a local service facility to provide routine and emergency service for all products used in this project.

B. Any Contractor, who intends to bid on this work and does not meet the requirements of the "Quality Assurance" paragraph(s), shall employ the services of an "Installer" who does meet the requirements and who shall provide the equipment, make all connections and continuously supervise the installation. A subcontractor so employed as the "Installer" must be acceptable to the

Architect/Engineer. The "Installer" shall be identified within thirty (30) days of notification to proceed for acceptance by the Architect/Engineer.

C. Because the life expectancy of this type of communications structure normally exceeds 10 years, the owner expects continuity from the service provider. If the installing/servicing company has not been an authorized provider of the manufacturers product for at least three (3) years, the following is required:

1. A list of (2) systems manufacturers of which they currently are authorized service providers where the relationship exceeds three (3) years.
2. A letter from the manufacturer outlining the details of changes in service providers over the last three (3) years and what actions they will take to ensure continuity of service to the customer.

D. Each major component of equipment shall have the manufacturers name, address and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, UL Label, or other data that is die-stamped into the surface of the equipment shall be easily visible.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Comply with NFPA 70

G. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.

H. Comply with UL 60950.

1.6 IN-SERVICE TRAINING

A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.

B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.

C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the staff and faculty members who attended, received, and completed the training program.

1.7 WARRANTY

A. Provide a manufacturer's five-year warranty of the school communications network equipment against defects in material and workmanship. This warranty will cover all electronic system components. Additional warranties cover clocks, speakers, and call in switches. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a one year warranty shall be provided for labor.

B. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary. The standard five-year warranty is an important element in establishing a standard in quality. Manufacturers who circumvent the five-year warranty by offering special "extended warranties" that are not part of their normal published warranty will not be accepted.

C. Contractor shall respond, excluding weekends and holidays, within 24 hours to any warranty service calls. If equipment cannot be repaired within 24 hours of service visit, the contractor shall provide "loaner" equipment to the facility at no charge.

D. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

1.8 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide the following system:

1. Telecenter manufactured by Rauland

a. Authorized Rauland Distributor contact:

(1) Jeff Bowers
Innovative Communications Systems, Inc.
775-825-2011
jbowers@innovativecomsys.com

PART 2 – PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. The platform shall utilize state of the art IP Technology for Call-in Notification, School Safety Paging and Evacuation tones, Atomic Time Synchronization, Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way hands-free Internal Communications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web-based and user friendly to allow the system administrator the ability to easily program system features.

B. Provide complete and satisfactorily operating district/school communications and district/school safety as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

C. The platform shall be a single electronic system consisting of a minimum of 10 audio channels for each campus, (classroom) IP Speaker Modules and call switches, IP Zone Modules connecting corridor speakers, inside and outside horns, IP Administrative Consoles, SIP enabled PBX integration and district-wide integration for paging, emergency notifications, calendar scheduling and configuration.

D. Each Classroom shall be provided with a Speaker Module interface and a minimum of 5 different call switches, each with their own annunciation path and priority.

E. Call-ins may automatically annunciate (display of priority and location) to administrative consoles, SIP enabled phones, and outside phones.

F. Call-ins shall be programmed to automatically change priority and annunciation route based on age of call-in and original priority.

G. Call-ins may have priority (and annunciation route) changed by user action from a console or SIP enabled phone.

H. Call-in annunciation route shall include playing pre-recorded audio over speakers, sending a pre-configured email, and activating relays.

I. The platform shall lend itself to expansion by simple addition of hardware modules.

J. The platform shall connect directly to an existing, standard protocol WAN/LAN network, without the need for a separate server at each school location. Configuration, including bell schedules, calendars, and emergency sequences can be remotely created, changed, stored and downloaded to the system by an authorized user from a web-based user interface.

K. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone or connected web browser within the facility or outside the facility to any other location within the facility or district.

L. The platform shall provide the ability to selectively communicate or monitor individual classrooms in emergency situations from any telephone within the facility or outside the facility to any other location within the facility; all communication within the classroom shall be hands-free and will not require any interaction by the classroom user.

M. The platform shall provide classroom users the ability to confirm that they have safely secured their classrooms during an emergency with a single button press. The front office administrator will receive confirmation that the classroom is safely secured via an administrative console and web-based user interface. The front office administrator can view classrooms that are not safely secured via the administrative console. The front office administrator can view classrooms that are not safely secured via the web-based user interface. The front office administrator shall be able to initiate two-way communication, without a pre-announcement tone, to the classroom during an emergency via the administrative console. Web-based user interface will still identify that a school is in an emergency, even if all classrooms are safely secured. Individual classroom check-in and school emergency status shall be viewed from the web-based user interface, both on-site and remotely.

N. IP Addressable and POE powered Speaker Modules for individual rooms shall be system programmable and may be assigned any two, three, four, five or six digit number as well as name and description. Any extension may be reassigned at any time.

O. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in a campus. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active, complying fully with all privacy legislation. Pre announce tone and supervisory tones shall be disabled during designated emergencies automatically.

P. The platform shall allow users to configure multiple schedules per school, with a minimum of 500 unique events per schedule, and automatic Daylight Savings time correction. Schedules can be programmed to occur once, daily, weekly, monthly, or in any combination of the preceding recurrences. Each school may have a minimum of 20 unique bell schedules, with a minimum of 5 active schedules on any given day for each campus. User shall be able to select from 25 standard included tones as well additional user created and uploaded audio files for class change signaling and messaging. In addition, scheduled events shall include relay actions, email notifications, and paging exclusions as system configuration changes. The platform shall allow control of the bell schedules via the district WAN/LAN without the need for a separate server at each school location. Bell schedules can be remotely created, changed, stored and assigned to calendar days for the local school by an authorized user from a web-based user interface.

Q. The platform shall be able to integrate with an existing PA system or operate as a fully independent IP solution. The platform shall be able to function in combination of said configurations, and allow for seamless communication within a school or district-wide, regardless of the type of configuration used. The platform shall be scalable, with the ability to easily add, install, and configure additional equipment to a system.

R. The platform allows for customization of preprogrammed sequences, used for emergencies, events, and everyday communications. Preprogrammed sequences can be activated from the push of a relay button, soft key of an administrative console, a dial string of a SIP phone, or a web browser configured to the district network. Sequences can be initiated automatically as part of a schedule or on the fly. Preprogrammed sequences can be customized to utilize any combination of audio tones, emails, relays, tone exclusions, swings, delays, duples, SIP phone notifications, and program distribution. Audio tones can include customized audio files and voice messages, recorded in any language. Uploaded audio tones and messages can be preprogrammed to annunciate repeatedly or individually, as part of a scheduled sequence or on the fly. Each school in a district can have its own customized sequences, and can be activated individually, in groups, or district-wide.

2.2 EQUIPMENT AND MATERIAL

A. Server Software

1. Provides district-wide paging, bell event scheduling, emergency notification and configuration for entire district.
2. Ability to configure system and initiate system features, per school and district-wide via web-based user interface.
3. The software has the ability to sync system time to the Atomic Clock Signal or to the school's or district's network time server.
4. The software will provide a web browser to deliver district-wide emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the district. The software must be capable of automatically notifying district personnel via the WAN/LAN of an alarm condition.
5. The software can automatically broadcast emergency instructions via associated system hardware throughout an entire district when an alarm (e.g. lockdown, lockout, security, fire) is initiated via the web-based user interface. The emergency instructions are preprogrammed and require no user intervention. Bell tones are able to be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
6. The software allows for user-uploaded pre-recorded messages and tones. Software supports the upload of MP3 and WAV file types. User-uploaded pre-recorded messages and tones can be part of emergencies, sequences, and bell schedules.
7. The software can be installed in cloud, virtual or physical server environments.
8. The web-based user interface supports secure HTTP browsing.
9. The software supports encryption to ensure secure access.
10. The system shall monitor itself if devices go offline and system actions are not received. Specified users shall receive email notifications when devices go offline. The software shall be able to keep a log and report on system activity within a school or all schools district-wide for a minimum of one year. These reports can be exported to excel spreadsheets.

11. The software will support a minimum of 20 bell schedules per school, with 5 schedules assignable to a specific school day. Bell schedules can be programmed to annunciate tones, activate relays, send emails, activate program distribution, and notify SIP phones.
12. The system allows programmable end points to be automatically included or excluded for live paging, bell tones, or prerecorded audio, depending on the time or day or day of the week. These inclusions/exclusions can be applied manually or automatically depending on their schedule.
13. The software can automatically send an email, as part of a programmed sequence of events, to district administrators alerting them of an emergency within the district.
14. The software provides the ability to view schools that are in an emergency status, using any web browser on the district's network. The software shall identify the name of the school in an emergency as well the type of emergency that school is in.
15. The software provides the ability to view individual classrooms that are not checked-in during an emergency, using any web browser on the district's network. The software shall identify the name, extension, and description of the classroom that is not checked-in during the emergency.
16. The system has a minimum of 5 customizable emergencies, one of them being an All-Clear – with the ability to return the system from an emergency to normal status. Each emergency shall have a minimum of 500 unique events.
17. As a district-wide communications solution, the system shall be able to provide simultaneous communications to all schools or groups of schools within a district. The system shall allow a user to initiate district-wide communications to individual schools, all schools or groups of schools, from a web-based user interface. The system shall allow a user to initiate prerecorded audio, live paging, or programmed sequences to individual schools, all schools or groups of schools, from the web-based user interface. Programmed sequences shall be customizable per school, and the system shall be able to activate them simultaneously to individual schools, all schools or groups of schools, from the web-based user interface.
18. The communications software must allow upgrade from an individual school system to multiple schools, or an entire school district, using the same web-based user interface. The communications software from an individual school system must be identical in typical user operation to the multiple schools or entire school district communications system software.

B. Campus Controller

1. Provides call routing for paging and intercom for a single facility.
2. System shall connect to the district provided Telephone Network via a SIP connection.
3. Support a flexible numbering plan allowing two, three, four, five, or six digit extensions.
4. SIP interface to a district provided Telephone Network shall be capable of allowing connected phones to display classroom call-ins, answer

internal intercom call-ins, make pages and change priorities of call-ins in progress.

5. Direct dialing, two-way amplified voice intercom between any provided telephone or admin console and speaker without the use of a press-to-talk or talk-listen switch.
6. Ability to upgrade priority level from individual call switch.
7. The ability to answer intercom call-ins registered at administrative consoles and pre-selected telephones.
8. The ability to automatically escalate incoming call-ins to an alternate telephone or group of telephones if they remain unanswered for a predetermined amount of time.
9. The ability to manually upgrade an intercom call-in to an alternate telephone or group of telephones.
10. The ability for classrooms to “check-in” via push button when they have successfully secured their location during emergency.
11. Administrative console shall display locations that have not checked in to confirm their secured location and provide hands-free audio monitoring and communication to unsecured locations.
12. The controller shall not need direct connection to any classroom via home run or distributed wiring. It shall communicate solely through the IP network.
13. Single button access from any console on the system to distribute emergency announcements within the facility to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative console shall have priority over all regular system functions.
14. Ability for administrative consoles and connected phones to selectively monitor audio at any two way speaker during an emergency.
15. Stores a minimum of 48 hours’ worth of Bell Event Schedules, all emergency notification sequences as well as facility wide configuration.
16. System has the ability to sync system time to the Atomic Clock Signal or to the school’s or districts network time server.
17. System’s SIP Interface shall provide:

    a. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire facility.
    b. Ability to answer a call-in directed to that SIP extension.
    c. Ability to upgrade a call-in directed to that SIP extension.
    d. Single button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
    e. Ability to initiate a school-wide emergency including lockdown and evacuate sequences.
    f. SIP device shall display call-in information from call in switch. Information will include a minimum of Classroom Name, Number, and Priority Level.

18. The system will have the ability to utilize a web browser and a USB microphone connected to the PC to deliver district-wide live emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the district. The system must be capable of automatically notifying district personnel via the WAN of an alarm condition.
19. The system can automatically broadcast emergency instructions throughout an entire campus when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. Bell tones are able to be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.

C. IP Addressable Modules:

1. System shall provide multiple IP Addressable Modules for intercom, paging and relay activation.

    a. All Modules are POE 802.3af compliant
    b. All Modules support DHCP.
    c. All Modules connect to network with a single RJ45 connector

2. IP Addressable Speaker Module

    a. Shall interface to school's data network, a classroom speaker, and multiple call switches.
    b. A minimum of 5 levels of call-in can be placed from an IP Speaker Module. The call-ins are routed to administrative consoles and select SIP connected telephones and can only be cleared from the system once answered. If a call-in is not answered within a preprogrammed time the call-in may reroute to other telephones, consoles, and speakers.
    c. An option for Privacy call in switches is supported. When the Privacy switch is activated it prevents administrative or classroom telephones from monitoring the specific classroom/location intercom speaker.
    d. The ability to belong to one or more of a minimum of 100 independent zones for zone paging, program/music distribution zones and class change tone zones; this assignment is a programmable function, changeable by time of day. Each IP Speaker Module's location shall be programmed in software to belong to any combination of software zones. IP Speaker Modules shall be designed to mount near ceiling and wall speakers and in the plenum space.
    e. Intercom and paging volume adjustable from Software interface.

3. IP Addressable Zone Paging Module

a. Zone Paging Module shall connect multiple speakers for district all page, all page, zone paging, bells, audio events and, emergency notification.
b. Zone Paging Modules shall be rack and wall mountable.
c. Zone Paging Modules shall be able to belong to one or more of 100 independent zones for live paging, bells, pre-recorded audio and emergency notification.

4. IP Addressable Aux I/O Module

a. Aux I/O Module shall have two input contacts and two output contacts.
b. Input and output contacts are individually addressable.
c. Aux I/O Module shall be wall and rack mountable.
d. User can program relays to be activated manually, through an event/bell schedule, or during emergency notification.
e. Aux I/O Module can perform school lockdown from a single press of a panic button.

5. IP Addressable Program Line Input Module

a. Program Line Input Module shall provide line level audio program distribution into system.
b. Program Line Input Module shall have a 3.5mm cable jack.
c. Program Line Input Module shall be configured via web-based user interface.
d. User can configure program distribution to be activated manually or automatically through an event/bell schedule.
e. Program Line Input Module will have a system priority level such that emergency communications override program distribution.

D. IP Addressable Analog Gateway

1. IP Addressable Gateway provides integration with existing analog wiring infrastructure – consisting of shielded two-pair classroom field wiring. The Gateway provides the ability to reuse speaker wiring, speakers, and punch blocks to integrate analog infrastructure with IP platform.
2. Each Gateway will have 5 watts of power per port and 25 watts total per device.
3. Supports 24 classrooms that utilize 25 Volt speakers and all current Telecenter call switches for front office notification.
4. Supports minimum of 5 call switch priorities per classroom, capable of lockdown check-in functionality, while reusing existing shielded two-pair classroom field wiring.
5. Classroom intercom volume adjustable from Software interface.
6. Classroom paging volume adjustable from Software interface.
7. Configured to the school network and can be used in conjunction with IP Addressable Modules.

E. IP Addressable Administrative Console

1. A full color screen with 64 soft keys, 3 line select, volume control, push to talk, speakerphone mode and left/right and up/down scrolling.
2. Audio paging access from any Console to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire school.
3. Programmable soft key access from any console on the system to initiate alarm signals within the school to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative console shall have priority over all regular system functions.
4. Programmable soft key access from any console to automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
5. Ability to perform intercom to any single IP Addressable Speaker Module.
6. Ability to display 3 call-ins at a time on the screen while other call-ins are annunciating and the ability to scroll to view all call-ins.
7. Ability to upgrade a call-in via soft key.
8. Programmable soft key access from any console for activating relays, campus wide.
9. Ability to maintain, along with controller and other IP Modules system functions, including intercom, bells and paging for the local campus in the event of district-wide connection loss.
10. Classrooms that have not 'checked-in' during an emergency are listed on the Administrative Console's screen.
11. The time duration of an emergency is shown on the screen of the administrative console. The check-in timer is shown on the screen of the administrative console.

F. Audio Paging/Program Amplifiers

1. Power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging speakers, and 15 watts of power to all paging horns.
2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.

G. Normal/Emergency Call Switch – Rauland Dual Level Call In Switch

1. Normal/Emergency Call Switches indicated on the drawings shall provide the following functions and features:

    a. One (1) "Normal" call switch that shall activate a distinctive "NORMAL" level call from single button activation. The button shall be clearly marked "NORMAL" and will route the call-in to any one or more Administrative Consoles and/or Marquee

Displays for quick and easy response from an Administrative Console.

b. One (1) “Emergency” call switch that shall activate a distinctive “EMERGENCY” level call from single button activation. The button shall be red in color and shall be clearly marked “EMERGENCY” and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.

H. Emergency/Check-In Call Switch – Rauland Check-In Call In Switch

1. Emergency/Check-In Call Switched indicated on the drawings shall provide the following functions and features:

a. One (1) “Emergency” call switch that shall activate a distinctive “EMERGENCY” level call from single button activation. The button shall be red in color and shall be clearly marked “EMERGENCY” and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.

b. One (1) “CHECK-IN” call switch that shall activate a distinctive “CHECK-IN” level call from single button activation. The button shall be blue in color and shall be clearly marked “CHECK-IN” and will route the call-in to any one or more Administrative Consoles. This button will be used for emergency check-ins during school emergencies, notifying the front office of the classroom occupants’ safety during an emergency.

I. Equipment Racks

1. All equipment racks shall provide 44 spaces (77”) minimum for mounted system equipment.
2. All equipment racks shall be multi-rack format (“gangable”) style, bolted together, and open cavity.
3. All equipment racks will be provided with lockable rear doors.
4. Equipment rack(s) shall be located in climate-controlled areas/rooms as shown on drawings.
5. All head-end, distribution, and source equipment, including data and power, shall be located in racks configured as approved by the Engineer.
6. Rack mounted equipment shall be accessible from front and rear.
7. All unused rack spaces will be covered with appropriate blank/vent panels.

J. Synchronized Clock System

1. Provide complete and satisfactorily operating NTP Synchronized Clock System with analog and/or digital secondary clocks as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated.
2. (NTP) Network Time Protocol is a network standard protocol that assures accurate synchronization to the millisecond of computer clock

times in a network of computers. Based on UTC, NTP synchronizes client workstation clocks to the U.S. Naval Observatory Master Clocks in Washington, DC and Colorado Springs, CO. Running as a continuous background client program on a computer, NTP sends periodic time requests to servers, obtaining server time stamps and using them to adjust computer clocks.

3. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features.
4. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information.
5. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
6. The NTP Synchronized System consists of a wired NTP receiver connected to a time server. Wired analog and digital clocks are synchronized to the NTP time. System shall synchronize all clocks to each other. System shall utilize NTP technology to provide atomic time to components.
7. System shall not require hard wiring for its components except for AC Power.
8. Analog Clocks shall synchronize to +/- 1 second of the transmitter displayed time.
9. Clocks shall automatically adjust for Daylight Saving per settings on the transmitter
10. The system shall have an internal clock that is continually updated by the NTP receiver. If a NTP failure were to occur, the clocks would continue to be synchronized to the internal clock and would not deviate from each other. Once NTP time is restored, all clocks would once again be synchronized to the NTP time.
11. The system must have a failsafe design so that if a power interruption were to occur, the clocks will continue to operate. If a sync signal is not received by the analog clocks for 48 hours, the second hand will double pulse to indicate this condition. Upon restoration of power, the transmitter will once again communicate with the clocks and normal operation will resume.
12. System shall be 100% programmable from the front operational panel with lights that indicate power status and NTP reception. Panel programming will also include Time Zone, Frequency, 12 or 24 hour operation and DST on/off.
13. The system may be modified to use GPS instead of NTP as the time source without the need to replace the transmitter. A GPS receiver would need to be added with access to the outside of the building.

K. Interior Ceiling Speakers

1. Provide Ceiling Speaker Assembly consisting of 8 Ohm, 8" speaker mounted in a 2 foot by 2 foot, or 2 foot by 1 foot, lay-in baffle, with an integrated back box that covers the full area of the baffle.

2. The speaker shall be connected by inserting an 8-pin RJ45 terminated CAT 5e or Cat 6 cable.
3. The speaker shall include provisions to allow attachment of a safety cable if required.

L. Wall Mounted Horns

1. Provide double re-entrant type horn loudspeakers with integral driver. The horn loudspeaker shall be impervious to weather and vandalism. Horn shall be constructed of heavy-duty ABS plastic. Horn loudspeaker drivers shall be rated at 15 watts with a frequency response of 480 Hz to 14 KHz. Sensitivity shall be 106 dB 1 watt, 1 meter. Transformer assembly shall be dual voltage multi-tap type suitable for 25 or 70-volt installations. Dispersion pattern shall be 180 degrees conical. The horn loudspeaker shall be constructed of treated heavy gauge aluminum, with all exposed parts potted and a sealed driver. Wiring terminal shall be fully enclosed. The speaker flange and mounting surface shall have a cork-rubber gasket. The horn loudspeakers finish shall be gray baked on enamel.
2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The back box shall be 10-3/4”x10-3/4”x6” deep.
3. The baffle shall be vandal proof, the faceplate constructed of 14-gauge carbon steel with a minimum tensile strength of 55,000 PSI. A lattice grid sub-plate shall deny access to the horn but be acoustically transparent for sound projection. Provide tamper proof, stainless steel mounting hardware. The baffle shall a mar/scratch baked epoxy rust inhibitive finish.

M. Uninterruptible Power Supplies (UPS)

1. UPS equipment provided for this system will include Power Conditioning to smooth current and voltage fluctuations.
2. UPS equipment will be sized in accordance with the system manufacturer’s recommendations.
3. Provide an individual UPS for EACH SYSTEM CONTROLLER (Gateway) furnished with the system.
4. Provide additional UPS(s) for protection of all other equipment furnished with the system and housed in the equipment racks.
5. All UPS equipment shall be rack mounted.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Furnish and install all material, devices, components and equipment for a complete operational system.

C. Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

E. All housings are to be located as indicated.

F. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.

H. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.

I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

J. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.3 GROUNDING

A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns,

noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

C. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.5 FINAL ACCEPTANCE TESTING

A. The Final Acceptance Testing shall be provided to the Owner or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner’s Representative establishing the “In Warranty” date. The warranty period will not commence until the Final Acceptance Test is completed.

C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.6 COMMISSIONING

A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.

B. Schedule training with Owner through the owners representative, with at least seven days advance notice.

3.7 OCCUPANCY ADJUSTMENTS

A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

3.8 CLEANING AND PROTECTION

A. Prior to final acceptance, the contractor shall vacuum, wipe down and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked and all cabinet keys will be turned over to the owner or designated owner's representative.

END OF SECTION

SECTION 275313 - WIRELESS CLOCK SYSTEM

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. All bids shall be based on the equipment as specified herein. The catalog numbers and model designations are that of the RAULAND-BORG CORPORATION. The specifying authority must approve any alternate system.

B. Bidders wishing to submit alternate equipment shall submit to the specifying authority, at least 10 days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications. Bidder shall provide adequate information prior to bid date such as specification sheets, working drawings, shop drawings, and a demonstration of the system.

C. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system at the contractor's expense.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. 27 05 00: Common Work Results for Communications.
2. 27 05 28: Interior Communications Pathways.
3. 27 08 00: Commissioning of Communications.
4. 27 15 00: Communications Horizontal Cabling.
5. Applicable Division 26 requirements for power and raceway coordination.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 SUMMARY

A. This Section includes a NTP Synchronized Wireless Clock System. It includes requirements for a NTP Synchronization system components including, but not limited to, the following:

1. Transmitter
2. NTP Receiver module
3. Wireless Analog Clocks (Battery/AC Powered)
4. Wireless Digital Clocks (AC Powered)

1.4 RELATED SECTIONS:

A. The following Division 16 Section may contain requirements that relate to this Section:

1. "Electrical Boxes and Fittings," for boxes, cabinets and fittings used for installation of transmitter for system
2. Intercom/Public Address for interface to bell system

1.5 SYSTEM DESCRIPTION

A. Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating NTP Synchronized Wireless Clock system.

1.6 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Submit equipment drawings with precise locations of transmitter, NTP receiver and all locations of clocks.
2. Submit product data sheets on each component, describing its operational and physical characteristics along with method of installation.
3. The system must operate in accordance with a “Radio Station Authorization” form FCC 601 granted by the Federal Communication Commission (FCC). Submit evidence of application for operating license prior to installing equipment. Furnish the license, or if the license has not been received, a copy of the application for the license, to the Owner prior to operating of the equipment. Upon receipt of license, deliver original license to owner.
4. Provide complete installation, set-up and maintenance instructions and submit a certificate of completion of installation and service training.

1.7 QUALITY ASSURANCE

A. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

B. The manufacturer must be a company specializing in the manufacturer of commercial timekeeping products with a minimum 30 continuous years of documented experience.

C. The contractor shall be an established electronics contractor that has had and currently maintains a locally run and operated business for at least 10 years. The contractor shall utilize a duly authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.

D. The contractor shall show satisfactory evidence, upon request, that the supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

E. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code" including, but not limited to:

1. Article 250, Grounding.
2. Article 300, Part A. Wiring Method.
3. Article 310, Conductors for General Wiring.
4. Article 725, Remote Control, Signaling Circuits.

5. EIA Compliance: Comply with the following Electronics Industries Association Standards:

6. Racks, Panels, and Associated Equipment, EIA-310-A.

F. Installation and start up of all systems shall be under the direct supervision of a local agency regularly engaged in installation, repair, and maintenance of such systems. The supplier shall be accredited by the proposed equipment manufacturers and be prepared to offer a service contract for system maintenance.

G. Contractor providing equipment shall be responsible for providing all specified equipment and mentioned services for all equipment as specified herein. Contractor must be a local authorized distributor of all specified equipment for single source of responsibility and shall provide documents proving such. Contractor must provide written proof that they are adequately staffed with factory-trained technicians for all of the specified equipment. Contractor must have established business for and currently be providing all services for the equipment to be provided for a minimum of 5 years.

H. The contractor shall guarantee availability of local service by factory-trained personnel of all specified equipment from an authorized distributor of all equipment specified under this section. On-the-premise maintenance shall be provided at no cost to the purchaser for a period of one (1) year (parts and labor) from date of acceptance unless damage or failure is caused by misuse, abuse, neglect, or accident. Additionally, all manufacturer supplied products must be covered by a five (5) year (parts only) limited warranty from the date of acceptance. The warranty period shall begin on the date of acceptance by the owner/engineer.

I. The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

J. The supplier shall visit the sites and familiarize himself with the existing conditions and field requirements prior to submitting a proposal.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in factory containers. Store products in a clean and dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.9 IN-SERVICE TRAINING

A. The contractor shall provide a minimum of 2 hours of in-service training with this system. Operators Manuals shall be provided at the time of this training.

1.10 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide a Rauland Telecenter U clock, bell, and paging system by Rauland, or an approved equivalent only where accepted by the Owner and Engineer prior to bid.

1. Telecenter manufactured by Rauland

a. Authorized Rauland Distributor contact:
(1) Jeff Bowers
Innovative Communications Systems, Inc.

775-825-2011

jbowers@innovativecomsys.com

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide one of the following systems:

1. Synchronized Wireless Clock System and secondary clocks manufactured by Rauland-Borg Corp.

B. The intent of this specification is to establish a standard of quality, function and features. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications.

C. The functions and features specified are vital to the operation of this facility, therefore, the acceptance of alternate manufacturers does not release contractor from strict compliance with the requirements of this specification.

D. Any proposed system that operates on an unlicensed frequency or has the FCC license in the name of someone other than the building owner will not be accepted.

E. The Contractor for this work shall be held to have read all the Bidding Requirements, the General Requirements of Division 1, and Contract Proposal Forms; and in the execution of this work, he will be bound by all of the conditions and requirements therein.

F. The contractor shall be responsible for providing a complete functional system including all necessary components whether included in this specification or not.

G. In preparing the bid, the bidder should consider the following:

1. No claim will be made against the owner for any costs incurred by the bidder for any equipment demonstrations which the owner requests.

H. Any prior approval of an alternate system does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with the operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.

I. Alternate equipment shall be considered if submitted to the specifying authority at least ten (10) days prior to bid date. Submission of an alternate shall contain engineering drawings of the system with specification sheets covering all components of the system as well as all items of Section 1 "SUBMITTALS." The system and equipment drawings and specifications sheet shall meet all items of the specification.

J. The specifying authority must approve any alternate supplier.

2.2 SYSTEM REQUIREMENTS

A. GENERAL:

1. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features.

2. Provide complete and satisfactorily operating NTP Synchronized Wireless Clock System with analog and/or digital secondary clocks as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated.
3. (NTP) Network Time Protocol is a network standard protocol that assures accurate synchronization to the millisecond of computer clock times in a network of computers. Based on UTC, NTP synchronizes client workstation clocks to the U.S. Naval Observatory Master Clocks in Washington, DC and Colorado Springs, CO. Running as a continuous background client program on a computer, NTP sends periodic time requests to servers, obtaining server time stamps and using them to adjust computer clocks.
4. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information.
5. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

B. SYSTEM DESCRIPTION AND OPERATION

1. The NTP Synchronized Wireless System consists of a master transmitter located on the inside of the building, and a NTP receiver connected to a time server. An unlimited number of wireless analog and digital clocks are synchronized to the NTP time.
2. System shall synchronize all clocks to each other. System shall utilize NTP technology to provide atomic time to components.
3. System shall not require hard wiring for its components except for AC Power. Analog Clocks may be battery operated for full portability if required.
4. Analog Clocks shall synchronize to +/- 1 second of the transmitter displayed time.
5. Clocks shall automatically adjust for Daylight Saving per settings on the transmitter
6. The system shall have an internal clock that is continually updated by the NTP receiver. If a NTP failure were to occur, the clocks would continue to be synchronized to the internal clock and would not deviate from each other. Once NTP time is restored, all clocks would once again be synchronized to the NTP time.
7. The system must have a failsafe design so that if a power interruption were to occur, the clocks will continue to operate. If a synch signal is not received by the analog clocks for 48 hours, the second hand will double pulse to indicate this condition. Upon restoration of power, the transmitter will once again communicate with the clocks and normal operation will resume.
8. Battery Powered Analog Clocks shall require 2 "D" cell batteries.
9. System shall be 100% programmable from the front operational panel with lights that indicate power status and NTP reception. Panel programming will also include Time Zone, Frequency, 12 or 24 hour operation and DST on/off.
10. The wireless backbone must support expansion of the system to include wireless alphanumeric displays for emergency crisis communications.

C. The system may be modified to use GPS instead of NTP as the time source without the need to replace the transmitter. A GPS receiver would need to be added with access to the outside of the building.

D. The system shall lend itself to expansion by simple addition of wireless secondary clocks and their required power source.

2.3 EQUIPMENT AND MATERIALS

A. WIRELESS TRANSMITTER

1. Rauland Model # WCXATRAN

a. FCC Part 90 Approved, 467.2125-467.4375 MHz frequency range
b. Radio Technology (Narrowband FM, 12.5 KHz bandwidth)
c. 10 selectively available channels
d. 5 watt transmitter
e. Daylight Savings Time pre-programmed
f. Time Zone Pre-set
g. Non-Volatile Memory
h. LCD Display for time, date, year, power, time zone and signal reception
i. Operating Range (32 degrees F to 158 degrees F)
j. Rack or Shelf Mount
k. Power Supply Input: 120-volt AC, Output: 12-volt DC, 3 Amps
l. 7” Rear Mounted Antenna
m. Dimensions: 12”L x 6”W x 1.75”H Weight: 2 lbs
n. NTP Receiver Model # WCXRVRNTP
o. Optional External Antenna
p. For use in large campus applications. Up to 2 miles radius

B. SECONDARY 13” ANALOG CLOCK

1. Rauland Model # WCA1312B

a. 13” Analog Clock (Battery Powered using 2”D” Cell batteries).
b. Maintenance Free.
c. Five year manufacturer’s warranty.
d. Microprocessor based with built-in wireless receiver
e. Heavy Duty Construction
f. Durable ABS Casing
g. Clock numbering graphics shall be Standard Arabic Format (12HR-60 Minute)
h. Face of clock is white
i. Hour and Minute hands shall be black, second hand is red
j. The clock lens shall use a shatterproof polycarbonate material with no visible molding marks. Glass and/or visible molding marks are unacceptable.
k. The clock shall have a low–profile, semi–flush design
l. Wire Guard Model #WCANA13WG in areas where protection is required as indicated on drawings or by owner.

C. SECONDARY 16” ANALOG CLOCK

1. Rauland Model # WCA1612B

a. 16” Analog Clock (Battery Powered using 2”D” Cell batteries).
b. Maintenance Free.
c. Five year manufacturer’s warranty.
d. Microprocessor based with built-in wireless receiver
e. Heavy Duty Construction
f. Durable ABS Casing
g. Clock numbering graphics shall be Standard Arabic Format (12HR-60 Minute)
h. Face of clock is white
i. Hour and Minute hands shall be black, second hand is red

j. The clock lens shall use a shatterproof polycarbonate material with no visible molding marks. Glass and/or visible molding marks are unacceptable.
k. Wire Guard Model #WANA16WG in areas where protection is required as indicated on drawings or by owner.
l. The clock shall have a low–profile, semi–flush design

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the NTP Synchronized Wireless Clock system.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Wiring Methods:

1. Install cabling concealed in conduit or above accessible ceilings. No exposed cabling is permitted except within telecom rooms. Provide plenum-rated cabling. Install Cat 6 cabling for paging system IP devices in accordance with Division 27 requirements, and terminate, label, test, and certify cabling as indicated on the Drawings. Provide 18/2 plenum speaker cable, 18/2 plenum 24VAC power conductors, patch cords, and miscellaneous cabling required for a complete system.

C. Control Circuit Wiring:

1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
2. All housings are to be located as specified and shown on drawings.
3. Make installation in strict accordance with approved manufacturer's drawings and instructions.
4. The contractor shall provide necessary transient protection on the AC power feed. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

D. Weatherproofing:

1. Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

E. Repairs:

1. Wherever walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.

3.3 GROUNDING

A. Provide equipment grounding connections for NTP Synchronized Wireless Clock systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

C. The contractor shall provide all necessary transient protection on the AC power feed leaving or entering the building.

D. The contractor shall note in his system drawings, the type and location of these protection devices as well as all wiring information.

E. The contractor shall furnish and install a dedicated, isolated earth ground from the central equipment rack and bond to the incoming electrical service ground buss bar.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection:

1. Make observations to verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Provide a list of final Atomic Clock Synchronized Master Clock system configuration.

C. Testing:

1. Test, commission, and demonstrate the complete clock, bell, and paging system at project completion. Testing and commissioning shall include verifying installation and support of all speakers and clocks, confirming speaker zones and tap settings, verifying rack-mounted equipment, confirming programming of paging zones, bell schedules, tones, and volume levels, verifying fire alarm mute interface operation, confirming integration with the existing Telecenter V system, and correcting deficiencies before acceptance.

3.5 COMMISSIONING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, programming, and preventative maintenance of the clock, bell, and paging system. Provide a minimum of 2 hours of training. Provide operator manuals, user guides, system documentation, and electronic operation and maintenance manuals at the time of training.

B. Schedule training with Owner through the Architect, with at least seven days advance notice.

3.6 OCCUPANCY ADJUSTMENTS:

A. When requested by the Architect within one year of date of Substantial Completion, provide on-site assistance in adjusting NTP Synchronized Wireless Clock system and adjusting controls to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.7 CLEANING AND PROTECTION

A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION 275313

SECTION 280000 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Include all labor, materials, tools, transportation, storage costs, excavation, training, equipment, insurance, temporary protection, permits, inspections, taxes and all necessary and related items required to provide complete and operational electronic safety and security systems as shown on the Drawings and described in the Specifications.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 05 00: Conductors and Cables for Electronic Safety & Security.
2. Section 28 05 26: Grounding and Bonding for Electronic Safety & Security.
3. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
4. Section 28 05 53: Identification for Electronic Safety & Security.
5. Section 28 20 00: Video Surveillance.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 QUALITY ASSURANCE

A. The Contractor installing the Electronic Safety and Security systems shall have a minimum of (5) years experience installing commercial security systems of similar size and scope.

B. See individual Division 28 specifications for additional requirements.

1.4 REGULATIONS AND CODE COMPLIANCE

A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and Local applicable codes and ordinances.

B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

C. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations as well as federal, state and local governmental agencies, including, but not limited to the following:

1. NFPA-70, 2023 - National Electrical Code (NEC).

2. Underwriters Laboratories (UL):

a. UL 50 - Enclosures for Electrical Equipment.
b. UL 294 – Access Control Systems
c. UL 365 – Police Station Connected Burglar Alarm Units and Systems
d. UL 609 – Local Burglar Alarm Units and Systems
e. UL 611 – Central Station Burglar-Alarm Units
f. UL 636 – Hold up alarms
g. UL 1076 – Proprietary Burglar Alarm Units and Systems
h. UL 1610 – Central Station Burglar-Alarm Units
i. UL 60950-1 - Information Technology Equipment - Safety.

3. Federal Communications Commission (FCC):

j. Code of Federal Regulations Title 47 - Part 15 – Radio Frequency Devices.
k. Code of Federal Regulations Title 47 - Part 68 – Connection of Terminal Equipment to the Telephone Network.

4. Americans with Disabilities Act (ADA).

1.5 DEFINITIONS

A.	Accessible Ceiling	Space above a ceiling constructed of removable tiles (clipped or unclipped). Acoustical ceiling grid with removal tiles would be considered an accessible ceiling. A gypboard ceiling would not be considered an accessible ceiling.
B.	Approved/Approval	Written permission to use a material or system.
D.	As Called For	Materials, equipment including the execution specified/shown in the Specifications.
D.	Code Requirements	Minimum requirements.
E.	Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
F.	Exposed	Work not identified as concealed.
G.	Final Acceptance	Owner acceptance of the project from the Contractor upon certification by the Owner's Representative.
H	Furnish	Supply and deliver to installation location.
I.	Furnished by Others	Receive delivery at job site or where called for and install.
J.	Inspection	Visual observations by Owner or Owner's Representative.
K.	Install	Mount and connect equipment and associated materials ready for use.
L.	Listed	Refers to classification by a standards agency.

M.	Or Approved Equal	Approved equal or equivalent as determined by Owner or Owner's Representative.
N.	Owner's Representative	Design professional or Consultant representing the Owner.
O.	Provide	Furnish, install and connect ready for use.
P.	Relocate	Disassemble, disconnect, and transport equipment to new locations: then clean, test, and install ready for use.
Q.	Replace	Remove and provide new item.
R.	Review	A general contractual conformance check of specified products.
S.	Satisfactory	As specified in Specifications.

1.6 INTENT OF DRAWINGS

A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner's Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy

B. Items mentioned in the Specifications and not shown in the Drawings or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner's Representative shall govern.

C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.

D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.7 REVIEW OF SPECIFICATIONS

A. The Contractor shall carefully study and compare the Drawings and Specifications. Any error, inconsistency or omission discovered shall be immediately reported to the Owner or Owner's Representative. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.

1.8 EXAMINATION OF THE PREMISES

A. The Contractor shall visit the Site to become familiar with the local conditions under which the work is to be performed and correlate the observations with the requirements of the Drawings and Specifications. No allowance will be made for claims of concealed

conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.

B. Before ordering any materials or performing any work, the Contractor shall coordinate the installation with the work of other trades and shall verify all measurements. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.9 COORDINATION OF CABLING PATHWAYS AND EQUIPMENT ROOMS

A. Drawings are diagrammatic in depicting the routing of security cabling pathways and the layout of security equipment.

B. The contractor shall coordinate the installation of all work with other trades including Mechanical, Electrical, Plumbing, Sprinkler, Structural and Architectural.

C. The contractor shall participate in coordination meetings with other trades prior to the installation of the work. For a specific space/area, the security contractor shall coordinate the routing and installation of all work with all other trades that have work in that specific space/area.

D. Prior to the installation of security cabling pathway including conduit, sleeves, etc., the contractor shall coordinate the routing of this pathway to avoid conflicts with and provide necessary clearances from the work of other trades. The contractor shall provide all horizontal offsets, vertical offsets and radius bends as necessary to coordinate the routing of the security pathways with the work of other trades and building structure.

E. Prior to the installation of equipment and/or cabling in the communication rooms, the contractor shall coordinate the layout of all equipment and cable pathways with the Telecom Contractor.

1.10 WARRANTY AND SERVICES

A. See individual Division 28 Specifications for warranty requirements.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. Electrical equipment and systems shall meet UL Standards and requirements of the National Electric Code. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the Specifications shall be performed in accordance with these requirements.

B. Equipment shall meet all applicable FCC Regulations.

C. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.

D. The listing of a manufacturer as "acceptable" does not indicate acceptance of a standard or cataloged item of equipment. All equipment and systems must conform to the Specifications.

2.2 WORKMANSHIP, SUBSTITUTIONS, WARRANTY

A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for a minimum of one (1) year from the date of final acceptance. Cable integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed free from defects, transpositions, open shorts, tight kinks, damaged jacket insulation, etc.

B. All labor must be thoroughly competent, skilled and trained, and all work shall be executed in strict accordance with the best practice of the trades.

C. The Contractor shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, improper installation or poor workmanship.

D. After the Contract is awarded, requests to substitute for specified materials shall be submitted by the Contractor to the Owner or Owner's Representative within thirty (30) days, complete with reasons for the substitution and savings which accrue to the Owner if the substitutions are approved. Substitutions after Contract award will be considered only if the substitutions are equal or superior to the products specified.

E. No material substitutions will be allowed except by written acceptance from the Consultant. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples are provided.

F. Approval of alternate or substitute equipment or material in no way voids the Specification requirements.

G. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submit to the Owner or Owner's Representative all evidence to support the contention that the item proposed for substitution is equal to the specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.

2.3 FACTORY ASSEMBLED PRODUCTS

A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit need not be products of the same manufacturer.
2. Component parts, which are alike, shall be from a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Components of equipment shall bear the manufacturer's name or trademark model number and serial number on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

B. Major items of equipment that serve the same function must be the same make and model.

C. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system

will result.

D. Maximum standardization of components shall be provided to reduce spare part requirements.

PART 3 – EXECUTION

3.1 ROUGH-IN

A. Before construction work commences, the Contractor shall visit the site and identify the exact routing of horizontal and backbone cable pathways.

B. All equipment locations and cabling pathway shall be coordinated with other trades and existing conditions to eliminate interference with required clearances for equipment maintenance and inspections.

C. Coordinate work with other trades and existing conditions to determine exact location of equipment and routing of cable pathways.

1. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. If, after installation of any equipment, piping, ducts, conduit, etc., it is determined that adequate space has not been provided for passage or maintenance, rearrange the work. Any changes in the size or location of the material or equipment supplied or proposed, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

D. Provide easy, safe and code mandated clearances at equipment racks and enclosures.

3.2 CUTTING, CORING AND PATCHING

A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the security cabling pathway system.

B. Protect existing finishes from water damage during core/cutting work and cleanup all related water and debris. Patch adjacent work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.

C. Contractor to submit all proposed concrete wall or floor penetrations to the Structural Engineer for approval prior to performing the work. Contractor shall locate and avoid cutting concrete reinforcing steel using current x-ray or pachometer equipment.

3.3 FIRESTOPPING

A. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

B. Firestopping assemblies shall meet or exceed the rating of the wall or floor being penetrated.

C. Fire stopping References:

1. ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.
2. ASTM E 119, Fire Tests of Building Construction and Materials (for fire-rated architectural barriers).
3. current NFPA edition adopted by the AHJ National Electrical Code, Section 800-52, Paragraph 2(b), Spread of Fire and Products of Combustion.

3.4 CONCEALMENT

A. Security cabling pathways including conduit, sleeves and tray shall be concealed above ceilings, in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, or in areas without ceilings, the Owner's Representative shall be notified of the proposed routing prior to starting that portion of the work.

B. All CAT 6 security cabling must be routed concealed above accessible ceilings or in conduit. No exposed security cabling is permitted with the exception of CAT 6 security cabling routed within the telecom rooms.

3.5 CONDUIT SEALING

A. All penetrations through slab-on-grade and concrete-filled metal decks to be sealed watertight. See Section 07 92 00 – Joint Sealants.

3.6 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

B. Where mounting heights are not dimensioned, install systems, materials and equipment to provide the maximum headroom possible.

C. Set all equipment to accurate line and grade, level all equipment and align all equipment components.

D. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises.

E. No equipment shall be hidden or covered up prior to inspection by the Owner's Representative. All work that is determined to be unsatisfactory shall be corrected immediately.

F. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

G. The Contractor shall replace all ceiling tiles damaged by work performed as part of the communications contract.

H. Storage and security of material and equipment shall be the responsibility of the Contractor.

END OF SECTION 280000

SECTION 280500 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, tools, transportation, storage costs, testing, training and related items required to provide a complete and operational video surveillance cabling and rough-in system, together with access control and intrusion detection rough-in only where shown on the Drawings and described in the Specifications. Active access control and intrusion detection head-end equipment, controllers, readers, detection devices, programming, licensing and final system commissioning are excluded unless specifically indicated otherwise.

B. Provide video surveillance Category 6 cabling, terminations, patch cords, camera mounting raceway and related rough-in as shown on the Drawings. Provide access control and intrusion detection conduit, backboxes, device rough-in, pathways and pull strings only where shown on the Drawings; do not include active access control or intrusion detection devices unless specifically scheduled or detailed as contractor-furnished.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 00 00: Common Work Results for Electronic Safety & Security.
2. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
3. Section 28 05 53: Identification for Electronic Safety & Security.
4. Section 28 20 00: Video Surveillance.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.

B. Perform all work in accordance with governing codes, rules and regulations including but not limited to the following:

1. NFPA-70, 2023 - National Electrical Code (NEC).
2. FCC Regulations:
   a. Part 15 – Radio Frequency Devices & Radiation Limits
3. Underwriter's Laboratories (UL): Applicable listing and ratings.
   a. UL 294: Access Control System Units
   b. UL 1076: Proprietary Burglar Alarm Units and Systems
4. Electronic Industry Association (EIA) testing standards

5. American Society for Testing and Materials (ATSM)
6. National Electrical Manufacturers' Association (NEMA)

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data sheets for the following items:

1. Wire and Cable for each system identified in the Division 28 Specifications.

PART 2 - PRODUCTS

2.1 WIRE AND CABLE

A. Install Category 6 cabling to video surveillance cameras and other IP-based security devices shown on the Drawings. Category 6 cabling shall be plenum rated, gray jacket, Belden/CDT 2413 008U1000 or approved equal, and shall be installed, terminated, labeled and tested by the Telecom Contractor in accordance with the Division 27 Specifications and the Horizontal Telecom Cable and Termination Schedule.

B. All non-IP electronic safety and security cabling associated with rough-in shall be routed in conduit from field device locations to the designated telecom room, security panel location, or nearest accessible pathway as shown on the Drawings. No exposed cabling is permitted. Conduit shall be sized so as not to exceed 40 percent fill. Outdoor exposed conduit shall be rigid metal conduit, IMC, or as otherwise indicated on the Drawings; concealed conduit routed in walls or above ceilings shall be EMT.

C. Provide cable type, conductor size, conductor quantity and shielding as recommended by the manufacturer of the equipment.

D. Do not share conduits with fire alarm or electrical systems.

E. Provide required wire and cable sized to allow for voltage drop on long runs and effectively shielded as required to allow the routing of 12 & 24V power and signal cable in the same conduit without interference or signal noise.

F. Cable installed outdoors or in underground conduit shall contain a PVC or Polyethylene jacket, flooded to prevent water intrusion.

G. Acceptable Manufacturers:

1. Belden.
2. Commscope.
3. Honeywell Genesis
4. Tappan.
5. Westpenn.
6. Or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Identify and label all wire and cable clearly with permanent labels in accordance with Division 27 requirements, WCSD-SCS-015, and the cable designation shown on the approved submittals or record drawings. Assign wire or cable designations consistently throughout a given system; each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations.

B. Secure all wire and cable run vertically in conduit for continuous distances greater than thirty (30) feet at the vertical run terminations. Non-coaxial cables shall be secured by screw-flange nylon cable ties or similar approved devices, Thomas and Betts or equal. Symmetrical clamping devices with split, circular or other wire conforming, nonmetallic bushings shall be provided for all other cables.

C. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.

D. Make all connections to screw-type barrier strips on panels and with insulated crimp-type spade lugs when appropriate. Size all lugs properly to assure high electrical integrity, i.e., low resistance connections.

E. Lace, tie or harness wire or cable as required herein, and in accordance with accepted professional practice. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point.

F. Wiring for shielding certain conductors from others or routing in separate raceways, shall be as recommended by the manufacturer's current requirements.

G. All wiring shall be installed in conduit and shall be of the size recommended by the equipment supplier.

H. Provide all necessary tie wires.

I. Follow manufacturers recommended guidelines for installation.

END OF SECTION 28 05 00

SECTION 280553 - IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

1. Provide all labor, materials, equipment, tools, transportation, storage costs and all necessary and related items required to provide a complete identification system for the Electronic Safety and Security (ESS) Systems included in the Contract Documents, including Video Surveillance and ESS rough-in/identification associated with access control and intrusion detection where indicated. Active access control and intrusion detection equipment is not included unless specifically shown or scheduled.

1.02 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 00 00: Common Work Results for Electronic Safety and Security.
2. Section 28 05 00: Conductors and Cables for Electronic Safety and Security.
3. Section 28 20 00: Video Surveillance.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1. Access control and intrusion detection work shown on the Drawings is limited to rough-in, pathway, cabling, identification, and coordination requirements only unless specifically noted otherwise. Active field devices, control panels, programming, licensing, monitoring, final connections, and system commissioning for those systems shall be provided by Owner or others as indicated in the Contract Documents.

1.03 REGULATIONS AND CODE COMPLIANCE

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.

B. Perform all work in accordance with governing codes, rules and regulations including but not limited to the following:

1. National Electric Code (NEC), NFPA 70.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s product data sheets for the following items:

1. Equipment cabinet and equipment enclosure labels.
2. Wire and cable labels.

B. Samples: Submit samples of the following items:

1. Include physical samples of each labeling material.

PART 2 - PRODUCTS

2.01 LABELS

A. Phenolic two tone for exterior mounting on equipment enclosures. White lettering on black background.

2.02 WIRE AND CABLE LABELS

A. Provide self-laminating adhesive laser labels.

B. Labels shall be machine printable with a laser printer.

C. Text Attributes:

1. Black
2. 1/8” high, minimum, or #12 font size
3. Font: Verdana preferred, SansSerif, or Arial acceptable
4. Printable area: 1.0” X .375” and 1.0” X 0.50”.
5. Cable size: 0.16 – 0.32” OD
6. Color: White

D. Manufacturer:

1. Brady wire marking labels WML–211-295 and WML-311-292.
2. Brother.
3. Thomas and Betts.
4. Or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Physically label all of the ESS Systems components including but not limited to the following:

1. Cables:
   a. Label at all termination points.
   b. Label at pullboxes, junction boxes and outlet boxes.
2. Label Access Control and Intrusion Detection System Cabinets.
3. Label Field equipment cabinets.
4. Label equipment within the cabinets and enclosures indicating its function.
5. Label equipment with its IP address (where applicable).
6. Label Terminal blocks.
7. Label Relays.
8. Label Patch panels, and the termination positions within the patch panels.

B. Identify wire and cable clearly with permanent labels wrapped about the full circumference within one (1) inch of each connection. Indicate the number designated on

the associated field or shop drawings or run sheet, as applicable. Assign wire or cable designations consistently throughout a given system; i.e., each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Label cables where cable first enters and exits from conduit, junction or distribution boxes; labels shall be located within six (6) inches of the point of exit.

C. Label all equipment mounted in the equipment enclosures indicating its function. This includes servers, switches, controllers, power supplies, batteries, etc.

D. Components, such as racks and patch panels, must be permanently marked with machine-generated labels, according to current practices and as approved by the Owner before installation.

E. Labels shall coincide with device id's use on the record drawings.

F. Equipment Enclosures.

1. Label all enclosures, alarm monitoring enclosures, and power supply enclosures associated with the security system with adhesive-backed phenolic labels. Use 12-point text.
2. Labels shall be represented in and match the security system record drawings.

G. Security Devices.

1. Label all equipment associated with the security system with a permanent machine generated, laminated, label. Use 12 point text with a clear background. Use white or black lettering depending upon the color of the device.
2. Label device in a concealed location with the system point number and address.
3. Label power supply batteries with the month and year they were installed.

H. Wire and Cable.

1. Label all wire and cable associated with the security system with permanent machine generated, laminated, labels. Use 12 point, black text on a white label.
2. All wire and cable labels shall be clearly visible without the need to remove wire management or any other obstructions.

END OF SECTION 280553

SECTION 282000 – VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, tools, transportation, storage costs, testing, training and all necessary and related items required to provide a complete and operational video surveillance system as shown on the Drawings and described in the Specifications.

B. Contractor shall furnish, install, mount, secure, aim, focus, configure, and update firmware for all scheduled IP video surveillance cameras. Contractor shall provide MAC address information and temporary login credentials to WCSD, assign IP addresses provided by WCSD, install patch cords, and cross-connect cameras to WCSD-designated PoE switch ports.

C. Install, mount, secure, aim, focus and adjust all IP video surveillance cameras. Aim cameras as directed by WCSD Project Manager.

D. Install CAT 6 cabling from each camera to patch panels as shown on the drawings. All CAT 6 cabling to be installed and tested in accordance with the Division 27 Specifications.

E. Furnish CAT 6 patch cords at the patch panel to connect the camera patch panel ports to owner furnished POE switches. WCSD Project Manager will provide designated pre-configured POE switch port numbers to the contractor. Contractor shall install patch cords and cross connect the cameras to the designated switch ports.

F. WCSD IT will furnish and install Milestone camera licenses and will provide, install, and configure Milestone recording server software, client viewing software, recording settings, and related VMS software entitlements unless specifically indicated otherwise in the Drawings.

G. WCSD IT will furnish and configure Milestone software.

1.2 RELATED SECTIONS

A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

B. Related Sections:

1. Section 28 00 00: Common Work Results for Electronic Safety & Security.
2. Section 28 05 00: Conductors and Cables for Electronic Safety & Security.
3. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
4. Section 28 05 53: Identification for Electronic Safety & Security.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 QUALITY ASSURANCE

A. The Contractor installing the IP video surveillance cameras and video recording software must have a minimum of (5) years experience installing video surveillance systems of similar size and scope.

B. The Contractor installing the IP video surveillance system must be a firm normally engaged in the design, installation and maintenance of integrated security systems including access control, intrusion detection and video surveillance.

C. The contractor installing the Category 6 cabling to the cameras must comply with the qualification requirements and installation requirements listed in the Division 27 Specifications.

D. The Contractor must be licensed by the Nevada State Contractors Board.

E. Formal, written evidence of the following may be requested at any point during the Bid or installation processes:

1. If requested, the Contractor, including any subcontractor, shall show proven expertise in the implementation of video surveillance projects. This expertise can be illustrated through the inclusion of details of at least three (3) projects involving the design and installation of video surveillance systems within the past three year period of similar size and scope. Names, addresses, and telephone numbers of references for the three projects shall be included.
2. In the event subcontractors are used for any portion of the installation or acceptance testing, the Contractor shall be responsible for any subsequent corrective action required on that portion of the work.

1.4 SUBMITTALS

A. Prior to procurement, the Contractor shall compare this Section against the camera schedule and plan symbols shown in the Drawings. Any discrepancy in camera type, model number, mount accessory, PoE requirement, cable termination, or detail reference shall be submitted as an RFI before ordering equipment.

B. Camera quantities shall be based on the camera schedules and plan locations shown in the Drawings. The Contractor shall verify the total camera count for each building package before procurement and shall notify the Owner or Owner’s Representative of discrepancies between the camera schedule, plan symbols, and this Section.

C. Manufacturer Product Data Sheets

1. Submit product data sheets in electronic PDF (portable document format).
2. Provide a table of contents for each submittal indicating the items being submitted. Products listed in the table of contents should be in the same order as they appear in the Specifications.
3. Provide product data sheets for all items listed in each specification section. Partial submittals will not be accepted.
4. Where product data sheets include more than one distinct item, clearly mark data sheet with arrow or other identifying means to clearly indicate the items being submitted for approval. Delete or cross-out non-applicable data.
5. Provide a camera submittal matrix identifying each scheduled camera number, camera type, manufacturer, model number, mount part number, environment, PoE requirement, serving telecom room, patch panel port, MAC address, IP address assignment, and drawing detail reference.

    a. Indoor fixed vandal resistant dome cameras.
    b. Outdoor fixed vandal resistant dome cameras.

c. Indoor fixed 2-sensor vandal resistant dome cameras.
d. Outdoor fixed 4-sensor vandal resistant dome cameras.
e. Camera supports shall include all wall mount kits, corner mount kits, pole mount kits, gooseneck support arms, ceiling pendant kits, recessed ceiling mounts, back boxes, adapters, shrouds, weatherproof accessories, custom extension arms, fasteners, and miscellaneous hardware required for the scheduled camera type, mounting condition, and detail reference.
f. CAT 6 Cabling – Indoor Plenum Rated.
g. CAT 6A Field Mount Plugs.
h. 48-Port CAT 6A Patch Panels.
i. CAT 6 Patch Cords.

1.5 REGULATIONS AND CODE COMPLIANCE

A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and local applicable codes and ordinances.

B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

C. All work and materials shall conform to and be installed, inspected and tested in accordance with federal, state and local governmental agencies, including, but not limited to the following:

1. ANSI/NFPA-70, current edition adopted by the Authority Having Jurisdiction - National Electrical Code (NEC).
2. Underwriter's Laboratories, Inc. (UL).
3. Federal Communications Commission (FCC).
4. Americans with Disabilities Act (ADA).

1.6 INTENT OF DRAWINGS

A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner's Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy

B. Items mentioned in the Specifications and not shown in the Drawings, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner's Representative shall govern.

C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.

D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.7 REVIEW OF SPECIFICATIONS

A. Prior to submitting a bid for the Project, the Contractor shall carefully study and compare the Drawings and Specifications and shall at once report to the Owner or Owner's Representative any error, inconsistency or omission discovered. During construction, if the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Specifications without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.

B. The Contractor shall not deviate from the specified scope of work as indicated in the Project Documents. Deviations include (but are not limited to):

1. Alteration of video surveillance camera locations from those specified in Plans.
2. Installation of horizontal cables to a different Telecom Room than indicated on the Plans.

1.8 EXAMINATION OF THE PREMISES

A. The Contractor shall visit the Site(s) to become familiar with the local conditions under which the work is to be performed and correlate his observations with the requirements of the Drawings and Specifications. No allowance will be made for claims of concealed conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.

B. Before ordering any materials or performing any work, the Contractor shall verify all measurements and be responsible for correctness of same. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.9 DELIVERY, STORAGE AND HANDLING

A. All items to be installed as a component of the IP video surveillance system for the Project shall be stored according to manufacturer's recommendations. In addition, all items must be stored in a location protected from vandalism and weather. Items shall not be stored outside. If air temperature at the storage location shall be below 40 degrees F, the equipment shall be moved to a heated 50 degrees F (minimum) location. If necessary, equipment shall be stored off site at The Contractor's expense.

1.1 WARRANTY

A. See Division 1 Specifications and General Conditions regarding Guarantee and Warranty requirements which apply to this Specification Section.

B. The Contractor shall provide the following warranty for the Video Surveillance System described in this specification section:

1. Warranty Start Date: The warranty period will begin after substantial completion of the project.

2. Complete System Warranty: The complete Video Surveillance System including all devices, equipment, cabling, software and programming shall be guaranteed to be free from defects in workmanship and materials for a minimum period of one (1) year from date of substantial completion. Promptly remedy such defects and any subsequent damage caused by the defects or repair thereof at no expense to the Owner.

3. Labor Warranty: Contractor to provide all labor as necessary to complete warranty repairs for a period of one (1) year from the date of substantial completion. During this labor warranty period, all services including equipment, labor, travel, expenses, etc., shall be provided during normal working hours at no cost to the Owner. The Contractor shall provide the Owner with a phone number for service. The Contractor shall respond within one (1) business day of receipt of a service call. The Contractor shall provide an on-site response time of two (2) business day for repair of critical system items during normal business hours.

4. Warranty Exclusions: The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.

1.10 FINAL ACCEPTANCE

A. General

1. All cameras mounted in accordance with the drawings.
2. IP address assigned to cameras and temporary login credentials provided to WCSD IT. Contractor to provide camera hardware MAC addresses to WCSD IT and WCSD IT will provide camera IP addresses to be assigned.
3. All CAT 6 cables installed, terminated, labeled and tested. Certified test reports submitted to WCSD.
4. All cameras properly aimed and focused as directed by WCSD IT.
5. All Punchlist items completed.

B. Inspection Of Work

1. WCSD Project Manager shall perform an inspection of all Contractor work prior to final acceptance. Any items that are found to be in error at this time shall be documented.
2. Documentation shall then be provided to the Contractor, who shall provide a date (within 30 days of WCSD Project Manager inspection) by which all items shall be corrected. The Contractor has the option to coordinate a site visit with the WCSD Project Manager in order to clarify and/or dispute the issues.
3. WCSD Project Manager shall perform a re-inspection of all Contractor work. Any remaining or additional items that are found to be in error shall again be documented. WCSD/IT reserves the right at this point to employ a separate contractor to make corrections at a cost to The Contractor.

PART 2 – PRODUCTS

2.1 FIXED INDOOR VANDAL RESISTANT 2 MP AND 4 MP DOME CAMERAS

A. Provide cameras meeting the following requirements:

1. The camera shall be of manufacturer’s official product line, designed for commercial/industrial 24/7/365 use.
2. The camera shall be based upon standard components and proven technology using open and published protocols.
3. 3. Provide fixed indoor vandal-resistant dome cameras as scheduled on the Drawings. Indoor dome camera models shall include Axis M3085-V, Axis M4215-V, and Axis M4216-V as indicated by camera location. Cameras shall provide minimum 2 MP or 4 MP resolution as scheduled, WDR/Lightfinder

performance, H.264/H.265 streaming, PoE operation, onboard analytics support, and vandal-resistant indoor dome construction.
4. RJ-45 Ethernet Connector. 10/100 Base-T.
5. IEEE 802.3af Compliant.
6. Mini-Dome.
7. Auto Zoom and Focus via Web Browser.
8. Vandal Resistant IK10 Rated.
9. H.264 video compression at 30fps.

B. Acceptable Products

1. Camera:
   a. Axis M3085-V, Axis M4215-V, and Axis M4216-V as indicated in the camera schedule and Drawings.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2. Recess ceiling mount.
   a. Provide recess ceiling mount kit where shown on drawings (Axis P/N TP3206-E).
   b. Mounting accessories shall be included with the camera where indicated as “INCLUDED” in the camera schedule. Provide manufacturer-recommended adapters, back boxes, recessed mounting kits, pendant kits, or other accessories required for the scheduled mounting condition.
   c. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2.2 FIXED INDOOR AND OUTDOOR VANDAL RESISTANT 5 MP AND 8 MP DOME CAMERAS

C. Provide cameras meeting the following requirements:

1. The camera shall be of manufacturer’s official product line, designed for commercial/industrial 24/7/365 use.
2. The camera shall be based upon standard components and proven technology using open and published protocols.
3. Minimum resolution shall be 5 MP for Axis P3277-LVE and 8 MP for Axis Q3548-LVE, or as otherwise indicated in the camera schedule and Drawings.
4. RJ-45 Ethernet Connector. 10/100 Base-T.
5. IEEE 802.3af Compliant.
6. Mini-Dome.
7. Auto Zoom and Focus via Web Browser.
8. Vandal Resistant IK10 Rated.
9. H.264 video compression at 30fps.

D. Acceptable Products

1. Camera:
   a. Camera: Axis P3277-LVE with AXIS TP3206-E mount where scheduled, mounting accessories, or other camera model specifically indicated in the Drawings for the camera type and Axis Q3548-LVE with AXIS TQ3601-E mount where scheduled.location.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2.2 FIXED 10-MEGAPIXEL DUAL-SENSOR VANDAL RESISTANT DOME CAMERA

B. Provide fixed dome cameras meeting the following requirements:

1. Camera shall consist of two (2) individual 5MP image sensors integrated into a single vandal-resistant dome housing.
2. Each image sensor shall be independently repositionable within the dome via a perimeter-mounted rotational support track, allowing flexible field of view placement.
3. Each sensor shall support independent pan and tilt adjustments to achieve the desired field of view.
4. Each sensor shall support remote focus and zoom capabilities over the IP network via standard web browser interface.
5. Each sensor shall provide a minimum resolution of 2592 x 1944 pixels (5MP).
6. Camera shall support dual-stream encoding in H.264, H.265, and MJPEG formats.
7. Entire camera assembly shall utilize a single RJ-45 10/100/1000Base-T Ethernet connection.
8. Entire assembly shall consume only one (1) camera license within the Video Management System (VMS).
9. Power shall be provided via Power over Ethernet (PoE+), compliant with IEEE 802.3at Type 2 standard.
10. Dome housing shall be vandal resistant and rated IK10.
11. Camera shall be rated IP66/IP67 for protection against dust and water ingress.
12. Suitable for both indoor and outdoor installations.
13. Support video frame rates up to 30 frames per second (FPS) at full resolution per sensor.
14. Support configurable privacy masking.
15. Operating temperature range shall be -30˚C (-22˚F) to +50˚C (122˚F).

C. Acceptable Products

1. Camera:
   a. Camera: Axis P4708-PLVE where indicated in the Drawings. Provide scheduled mounting accessories and no substitutions unless approved by WCSD and the Engineer prior to procurement.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2.3 FIXED 20 MEGAPIXEL 4-IMAGE SENSOR MULTIDIRECTIONAL VANDAL RESISTANT DOME CAMERAS

a. Provide cameras meeting the following requirements:

1. Camera will consist of 4 individual 5MP fixed cameras installed in a single vandal resistant dome.
2. Each of the 4 cameras within the dome shall be capable of being repositioned within the dome by moving it around the perimeter of a circular support track.
3. Each of the 4 cameras within the dome shall be capable of being independently aimed up and down, side to side.
4. Each of the 4 cameras within the dome shall be capable of being remotely focused and zoomed over the IP network via a web browser.
5. Each of the 4 cameras will have a minimum 5MP 2560x1440 Resolution per sensor.
6. Dual encoder (H.264 and MJPEG).
7. The entire camera assembly will one RJ-45 Ethernet Connector, 10/100 Base-T.

8. The entire camera assembly will require 1 software camera license within the VMS software.
9. Power shall be provided via Power over Ethernet Plus (PoE+), compliant with IEEE 802.3at, as required by the scheduled Axis P3737-PLE multi-sensor camera.
10. Vandal Resistant and IK10 Rated.
11. IP 66 Ingress and Weather Rated.
12. Indoor/Outdoor rated.
13. Video frame rate (up to) 30FPS @ full resolution.
14. Privacy masking.
15. Operating temperature -30˚C (-22 °F) to +50˚C (122 °F).

b. Provide corner mount kit, gooseneck support arm and shroud to mount cameras on exterior corners of buildings as shown on the drawings. Provide additional mounting plates, adapters and accessories as necessary for a vandal resistant and weatherproof installation.

c. Acceptable Products

1. Camera:
   a. Axis P/N P3737-PLE.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2. Pendant Mount:
   a. Provide pendant mount kit where shown on drawings including AXIS TP3302-E and AXIS T94N01D mounting accessories, with custom length 1.5 NPT extension column as required to clear ceiling or canopy obstructions.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

3. Exterior Corner Mount:
   a. Provide exterior corner or wall mounting accessories as scheduled, including AXIS TP3302-E and AXIS T94N01D where indicated. Provide additional brackets, back boxes, adapters, fasteners, and weatherproof accessories required for a secure, vandal-resistant, and weatherproof installation.
   b. No substitutions unless approved by WCSD and the Engineer prior to procurement.

4. Exterior Pole Mount:
   a. Provide pole mount kit where shown on the drawings including stainless steel bands and mount (Axis P/N T91B57), mounting cabinet (Axis P/N T98A18-VE), wall mount arm (Axis P/N T91D61) and camera pendant kit (Axis P/N T94N01D).
   b. Where listed as “INCLUDED” in the camera schedule, provide the manufacturer’s standard mounting accessories and all additional hardware required for the installation condition shown on the Drawings.
   c. No substitutions unless approved by WCSD and the Engineer prior to procurement.

2.2 HORIZONTAL PLENUM RATED CATEGORY 6 CABLE.

A. See Section 271500 for requirements.

2.3 CATEGORY 6A FIELD MOUNT PLUGS

A. See Section 271500 for requirements.

2.4 CATEGORY 6 COPPER PATCH PANELS

d. See Section 271100 for requirements.

2.5 CATEGORY 6 COPPER PATCH CORDS

A. See Section 271100 for requirements.

2.6 VIDEO MANAGEMENT SOFTWARE SYSTEM

a. WCSD IT will provide and install Milestone camera licenses.

b. WCSD IT will provide, install and configure Milestone recording server and client viewing software.

PART 3 – EXECUTION

3.1 CAMERA SYSTEM INSTALLATION SEQUENCE AND COORDINATION WITH WCSD

A. The following is the installation sequence for the camera system. The contractor shall coordinate and schedule all work with WCSD's Project Manager.

1. Contractor shall procure cameras and provide a spreadsheet to WCSD Project Manager indicating the camera number, MAC address and camera name. The camera numbers shall match the numbers in the camera schedule. WCSD will provide IP addresses for each camera. Contractor shall configure the cameras with the provided IP addresses and shall update all cameras with current manufacturer firmware.
2. Contractor shall provide camera and temporary login credentials to WCSD Project Manager.
3. Contractor shall install, terminate and test cabling to the cameras. Contractor shall provide certified cable test results to WCSD Project Manager and provide patch cords for the cameras. WCSD IT will inspect the cabling installation and will issue a punchlist identifying any corrective action required.
4. After the contractor has completed all punchlist items, WCSD IT will install the POE switches and will provide designated pre-configured POE switch port numbers to the contractor. Contractor shall install patch cords and cross connect the cameras to the designated switch ports.
5. Contractor shall connect, aim, focus and adjust the cameras. Each camera view must be reviewed and signed off by WCSD Project Manager.
6. WCSD IT will complete all remaining Milestone Software configuration including:

    a. Installation of Milestone recording server and software at the project site.
    b. Installation of camera licenses. Camera licenses provided and installed by WCSD IT.
    c. Configuration of camera settings including frame rate, compression, motion detection, privacy masking, recording, etc.
    d. Installation of Milestone Smart Client software on workstation computers at the project site.

3.2 ROUGH-IN

A. Before construction work commences, the Contractor shall visit the site and identify the exact location and mounting of all cameras.

B. Camera mounting locations shall be coordinated with the work of other trades including ductwork, return and supply grills, lights, switches, exit signs, fire sprinklers, smoke detectors and structure. Cameras, mounts, raceway and cabling shall be installed so as not to interfere with required clearances for maintenance and inspection of equipment.

C. Notify the Owner's Representative of any obstructions that may block the camera views shown on the Drawings.

D. The contractor shall minimize the amount of exposed conduit and boxes exposed to view. Paint all interior and exterior conduit exposed to view to match adjacent surfaces. All exterior conduit shall be rigid RMC with water tight boxes and fittings.

E. All exposed screws and fasteners used for camera mounting hardware, conduit supports, j-boxes and pull boxes shall be vandal resistant (Torx Pin-Head Style).

3.3 CUTTING AND PATCHING

A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the camera installation. Patch adjacent work disturbed or damaged by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.

B. The contractor shall be responsible for repairing any ceiling tile, ceiling grid, ceiling supports or adjacent surfaces damaged during the installation of the cameras.

C. All penetrations through the building envelope shall be sealed and made water tight.

D. All penetrations through fire rated walls, floors and ceilings shall be fire stopped with a UL listed fire stop system meeting or exceeding the rating of the assembly being penetrated.

E. No roof penetrations are permitted. Where cameras, conduits, or mounting supports are located near roof edges, canopies, fascia, or roof hatch areas, route raceway from accessible ceiling or wall locations and coordinate final routing to maintain the building envelope without penetrating the roof assembly.

3.4 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

B. Set all cameras and associated supports to accurate line and grade, level all equipment and align all equipment components.

C. Provide all scaffolding, rigging, hoisting and services necessary for installation of equipment.

D. Storage and security of material and equipment prior to installation shall be the responsibility of the Contractor.

3.5 CEILING DOME CAMERA MOUNTING AND NETWORK CONNECTION

A. Install ceiling mounted dome cameras and support brackets in accordance with the Manufacturer's instructions.

B. Verify ceiling mounted camera locations shown on the drawings. The contractor shall verify that adequate clearances exist above the camera to allow installation at the locations shown. The contractor shall make minor adjustments to the camera locations to avoid clearance conflicts.

C. Secure cameras to structure with mount kit called out in the camera schedule.

D. Furnish, install, and terminate Category 6 cabling from each IP camera to the telecom room or existing MDF location identified on the Drawings. At existing telecom locations, terminate camera cabling on existing 48-port patch panels where indicated and coordinate exact termination locations with WCSD.

E. Terminate CAT 6 cable at the camera on CAT 6A Field Mount Plug and connect directly to the camera.

F. The contractor shall work with the WCSD IT department to cross connect the cameras to the POE switches in the telecom rooms.

G. The contractor shall assign static IP addresses to the camera with the IP address scheme specified by WCSD IT.

H. Verify that the camera has the most current firmware version. If not, download and install the latest firmware version from the manufacturer's website.

3.6 EXTERIOR GOOSENECK CAMERA MOUNTING AND NETWORK CONNECTION

A. Notify the Owner's representative where obstructions exist that may block the view from the camera prior to installing the camera.

B. Install fixed dome cameras, corner mount kits, gooseneck supports and shrouds in accordance with the Manufacturer's instructions.

C. Core drill exterior building and install rigid conduit to feed the camera via the support bracket.

D. For cameras connected to existing surface-mounted junction boxes or existing conduit pathways, reuse existing pathways where indicated on the Drawings, field verify pathway capacity and condition, and provide new conduit, pull boxes, fittings, and watertight accessories as required for a complete installation.

E. Paint exposed conduit to match existing surfaces.

F. Securely anchor corner mount kit and/or gooseneck support bracket to structure.

G. Install camera shroud and connect camera to shroud.

H. Verify that camera and mounts are level and plumb.

I. Verify that all components are secure to prevent vibrating or unstable images caused by wind or vibration.

J. All exposed screws and fasteners shall be vandal resistant (Torx Pin-Head Style).

K. Furnish, install, and terminate Category 6 cabling from each exterior IP camera to the telecom room or existing MDF location identified on the Drawings. At existing telecom locations, terminate camera cabling on existing 48-port patch panels where indicated and coordinate exact termination locations with WCSD.

L. Terminate CAT 6 cable at the camera on CAT 6A Field Mount Plug and connect directly to the camera.

M. The contractor shall coordinate and work with the WCSD IT department to cross connect the cameras to the POE switches in the telecom rooms.

N. The contractor shall assign static IP addresses to the camera with the IP address scheme specified by WCSD IT.

O. Verify that the camera has the most current firmware version. If not, download and install the latest firmware version from the manufacturer's website.

3.7 FIXED CAMERA SETUP, FOCUSING AND ADJUSTMENT

A. Contractor shall connect, aim, focus, adjust, and assist with analytics configuration for each camera. Final camera orientation, field of view, focus, exposure settings, and analytics configuration shall be reviewed and approved by WCSD prior to system acceptance.

END OF SECTION

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes fire alarm control panels, manual fire alarm stations, automatic smoke and heat detectors, fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.

B. Related Sections:
1. Section 08 71 00 - Door Hardware: Door closers, electric locks, electric releases.
2. Section 21 12 00 - Fire-Suppression Standpipes: Flow detection and alarm devices.
3. Section 21 13 13 - Wet-Pipe Sprinkler Systems: Flow detection and alarm devices.
4. Section 23 33 00 - Air Duct Accessories: Smoke dampers.
5. Section 25 50 00 - Integrated Automation Facility Controls.
6. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
7. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
8. Section 28 05 53 - Identification for Electronic Safety and Security.

1.2 REFERENCES

A. National Fire Protection Association:
1. NFPA 72 - National Fire Alarm Code.

1.3 SYSTEM DESCRIPTION

Division 28 31 00 is a performance specification. The Contractor shall include all labor and materials to design and complete the entire fire alarm work as herein specified and/or indicated.

The fire alarm system shall be a voice alarm communications system.

The Contractor is to serve as the complete system designer and installer. A complete fire alarm system shall be designed, furnished, and installed by the Contractor including locations, types, and quantities of all devices, monitoring devices, and equipment required. Contractor’s design shall be based on all bid documents, including but not limited to Electrical, Telecom, Mechanical, Fire Sprinkler, Kitchen, Architectural, and Structural documents. Contractor shall provide all devices, modules, etc. for a complete operating system as required by all applicable Codes and AHJ requirements. Therefore, it is the Contractor’s responsibility to include in the bid price the complete design and installation of all devices (whether shown or not), wiring, head-end equipment, etc. to meet the applicable code and AHJ requirements. The Fire Alarm System is indicated on the drawings and specifications in either criteria or schematic form only.

The Contractor shall refer to Telecom drawings for information regarding Code Red system integration and monitoring of all emergency communication/code red systems. Submit shop drawing indicating code red strobe device locations to Engineer of Record and Owner for review prior to installation.

A. Fire Alarm System: NFPA 72, addressable and automatic local fire alarm system with connections to central station.

B. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
   1. Local fire alarm signaling devices sound and display with signal.
   2. Non-coded signal transmits to central station.
   3. Location of alarm zone indicates on fire alarm control panel and on remote annunciator panel.
   4. Signal transmits to building elevator control panel, initiating return to main floor or alternate floor and lockout for fire service.
   5. Signal transmits to building mechanical controls, shutting down fans and operating dampers.
   6. Signal transmits to release door hold-open devices.
   7. Signal releases magnetic door hold opens.
   8. Signal releases electric door locks.

C. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.

D. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:
   1. Visual and audible trouble alarm indicates at fire alarm control panel.
   2. Visual and audible trouble alarm indicates at remote annunciator panel.
   3. Trouble signal transmits to central station.

1.4 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate annunciator layout, and design calculations. Provide separate shop drawing for review of Code Red amber strobe locations.

C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.

D. Test Reports: Indicate procedures and results for specified field testing and inspection.

E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

F. Contractor shall submit to the AHJ. Include all associated costs, fees, drawings, cut sheets, calculations for a complete submittal in bid price.

G. Contractor shall submit copies of installing company licensure, and individuals responsible on project site responsible for installation of all fire alarm devices and cabling. All individuals on site shall be at a minimum, NICET II certified and State of Nevada ‘F-card’ holders.

1.5 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents: After construction “as-built” drawings shall be provided to the WCSD Plant Facilities and Capital Projects & Planning Departments. “As-built” drawings shall be as specified in Part 1 of these Guidelines. No marked “jobsite copies” will be allowed. As-built drawings shall show all horn/strobes, heat and duct detectors, splitter points, pull stations, and their specific addresses. As-built shall also show floor to floor penetrations. In addition, door magnets (and their power source), burglar alarm devices, HVAC connections, dampers and

contractors shall be shown. All other devices both electrical and mechanical not previously designated that are tied to Fire Alarm Panels or are a part of the Fire System Operation shall be shown.

C. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.

B. Installer: Certified fire alarm installer with service facilities within 100 miles of Project.

C. Design fire alarm under direct supervision of Professional Engineer or NICET II certification experienced in design of this Work and licensed in State of NV.

1.8 MAINTENANCE SERVICE

A. General Conditions: Maintenance service.

B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

1.9 MAINTENANCE MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish five manual station break-glass rods.

C. Furnish two keys of each type.

1.10 EXTRA MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish one of each type of automatic smoke detector without base.

PART 2 - PRODUCTS

2.1 CONTROL PANEL

A. Manufacturers – per WCSD Standards:
1. GE EST-4, no exceptions.

B. Product Description: Modular addressable fire alarm control panel with flush surface wall-mounted enclosure.

C. Power supply: Adequate to serve control panel modules, remote detectors, remote annunciators, smoke dampers, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 15 minutes.

D. System Supervision: Component or power supply failure places system in trouble mode.

E. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition place's circuit in trouble mode.

F. Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode.

G. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver. Provide and install cellular dialer communicator listed for fire alarm panel monitoring. Locate equipment and antenna as required for optimal cell signal reception on premises.

H. Auxiliary Relays: Sufficient SPDT auxiliary relay contacts to provide accessory functions specified.

2.2 MANUAL FIRE ALARM STATIONS

A. Product Description: Manual double-action station with break-glass rod. Manual Pull Stations shall be constructed of metal and double-action (not break-glass type). Provide with STI Stopper® II with Horn or equivalent (clear, tamperproof polycarbonate cover with sounder) unless noted otherwise on plans.

B. Mounting: Semi-Flush.

C. Type: Coded.

D. Backbox: Manufacturer's standard.

2.3 SPOT HEAT DETECTOR

A. Product Description: Addressable combination rate-of-rise and fixed temperature, spot heat detector.

B. Temperature Rating: 135 degrees F (57 degrees C).

C. Rate-of-Rise: 15 degrees F (8.3 degrees C).

2.4 CEILING SMOKE DETECTOR

A. Product Description: NFPA 72, addressable photoelectric type ceiling smoke detector with the following features:
   1. Adjustable sensitivity.
   2. Plug-in base.
   3. Auxiliary relay contact.
   4. Integral thermal element rated 135 degrees F (57 degrees C).
   5. Visual indication of detector actuation.

B. Mounting: 4 inch (102 mm) outlet box.

C. Furnish two-wire detector with common power supply and signal circuits.

2.5 DUCT-MOUNTED SMOKE DETECTOR

A. Product Description: NFPA 72, addressable with the following features:
1. Auxiliary SPDT relay contact.
2. Key-operated normal-reset-test switch.
3. Duct sampling tubes extending width of duct.
4. Visual indication of detector actuation.
5. Duct-mounted housing.

B. Furnish two-wire detector with common power supply and signal circuits.

C. See mechanical plans for additional information.

2.6 ALARM STROBE

A. Provide low profile wall mounted. Low profile strobes shall mount in a North American 1-gang box, and protrude less than 1” from the finished wall. The word FIRE shall be prominently displayed on the housing. All devices shall be WHITE with RED lettering (confirm with architect).

B. The strobes shall be EDWARDS Genesis G1 Series.

2.7 REMOTE ANNUNCIATOR

A. Product Description: Remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Provide microphone for system input where shown, all other annunciators shall be LCD display only.

B. Mounting: Semi-flush mounting in factory provided backbox with lockable door and viewing window.

2.8 DOOR RELEASE

A. Product Description: See architectural hardware specifications. Provide all required connections/wiring, relays, modules, and transformers as required.

2.9 WIRE AND CABLE

A. Cable located in Plenums: Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.

B. All fire alarm conductors routed underground shall be wet location rated.

C. Fire alarm circuit conductors have insulation color or code as follows:
1. Power Branch Circuit Conductors: Black, red, white.
2. Initiating Device Circuit: Black, red.
3. Detector Power Supply: Violet, brown.
4. Signal Device Circuit: Blue (positive), white (negative).
5. Door Release: Gray, gray.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify products and systems receiving devices are ready for installation.

3.2 INSTALLATION

A. Install manual station with operating handle 48 inches above floor.

B. Install audible and visual signal devices 80 inches above floor to bottom of device.

C. Install 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors in conduit.

D. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

E. Mount outlet box for electric door holder to withstand pulling force of specified door holder.

F. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, and duct smoke detectors.

G. Automatic Detector Installation: Conform to NFPA 72.

H. Install engraved plastic nameplates in accordance with Specifications.

I. Ground and bond fire alarm equipment and circuits in accordance with Section 26 05 26.

J. Fire Alarm Junction Boxes shall be painted RED with labeling indicating circuiting inside junction box, such as “FIRE ALARM – STROBE - BPS 2 CIRCUIT 1”.

K. Addressable devices shall be provided with labels indicating device address. Relays, control modules, monitor modules or other devices of similar type shall be labeled with their function and address, such as “HP-19 SHUTDOWN RELAY”.

L. All devices subject to physical damage where installed shall be provided with a manufacturer’s protective device cage.

3.3 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Test in accordance with NFPA 72 and local fire department requirements.

3.4 MANUFACTURER'S FIELD SERVICES

A. General Conditions: Manufacturer’s field services.

B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.5 DEMONSTRATION AND TRAINING

A. Furnish 4 hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

END OF SECTION 28 31 00

STEAM PROGRAM
(Science, Technology, Engineering, Art, Math)

PARTICIPANT GROUPS & TASKS

School construction projects that are constructed on an occupied campus present a unique opportunity to enhance the academic and pedagogic mission of the school. This document outlines the implementation for STEAM Focused Educational Engagement during the design and construction period, which often can last from 1-3 years depending on the size and complexity of the project. The process requires participation from WCSD capital projects staff, the design consultants, the contractor, sub-contractors and school leadership & teaching staff. It is the intention that this effort be focused and, integrated into the academic instruction of the school being modernized. The scope of educational engagement shall be appropriate to the size, scope, grade and engagement of the school. For example, the instructional activities for an elementary art school class can be quite different than a middle school math class or high school electronics class. This document is intended to be a guide only and can be expanded to meet the unique needs of each school and level. **See STEAM PROCESS.**

Each participant group below will identify 1-2 representatives/staff to participate in the STEAM program as defined below and appropriate for each task.

School staff, Contractor and Architecture and Engineering team shall plan, develop & implement the educational engagement during construction, relevant and appropriate to the K-5 age group.

School leadership will identify opportunities where in-class content and project team education activities are aligned for the purposes of in-class content. They will assist in scheduling teacher and staff time for educational planning.

General Contractor/CMAR and Trade Partners – The Contractor or Construction Manager at Risk (CMAR), in conjunction with, school leadership, will help develop education content for STEAM activities during construction. They will assist with developing the schedule for activities to ensure minimal disruption to construction & safety during all site visits. The Contractor or CMAR may choose to bring enhancements or outside experts to add further content to each activity.

Architect/Engineer(A/E) & Sub-Consultants – The consulting team will help develop education content. The A/E Team will, where needed, assist in the development of graphic material to support educational content delivery. The A/E and consulting team will, where needed, lead the educational content development and delivery.

District Capital Projects (CP) Staff – CP Staff will be involved throughout the planning and engagement process. The engagement plan and schedule will be reviewed and approved by CP Staff. Where appropriate, additional District input and review will be provided. Staff will coordinate all activities as appropriate.

STEAM ENGAGEMENT PROCESS EXAMPLE

Task	Personnel/Resources	Activity / responsibility	Duration/Timeline
Curriculum Planning Meeting #1: Overview of STEAM program with all school staff to discuss the program opportunities and objectives.	Design consultants 1-2 staff Contractor 1-2 staff Sub- contractors 1-2 staff WCSD Cap. Projects 1-2 staff WCSD Student Advisory 1-2 staff WCSD - All teaching staff and school leadership	Discuss how the STEAM process can enhance instruction and ideas and how to do so. Contractor and WCSD there for support. School leadership shall encourage participation	1 hour
Curriculum Planning Meeting #2: Meeting with interested teaching staff. Instructors start to establish education objective relative their course.	Design consultants 1-2 staff Contractor 1-2 staff Sub- contractors 1-2 staff WCSD Cap. Projects 1-2 staff WCSD Student Advisory 1-2 staff WCSD - All teaching staff and school leadership	Discussion to help identify areas where staff can utilize design and construction themes into their instruction and how the STEAM activities can overlap with additional mandates such as, Student Learning Objectives, Project based learning, School performance plan within the academic dept./team, student-led presentations or parent nights etc.	1 hour
Curriculum Planning Meeting #3: Meeting with interested teaching staff and site leadership to determine content areas that can be covered during STEAM process.	Design consultants 1-2 staff Contractor 1-2 staff Sub- contractors 1-2 staff WCSD Cap. Projects 1-2 staff WCSD Student Advisory 1-2 staff WCSD - All teaching staff and school leadership	Design Team help to facilitate the content areas to be covered with contractors during STEAM process. Identify and match the contractor/sub-contractors with the teaching staff based on the content.	1 hour
Café meeting # 1 Round tables This may shift to be more of a match of teachers with contractors based on content at these round tables to develop activities to enrich the STEAM content to be covered.	Design consultants 1-2 staff Contractor 1-2 staff Sub- contractors 1-2 staff WCSD Cap. Projects 1-2 staff WCSD Student Advisory 1-2 staff Interested STEAM teaching staff and school leadership	Design team/Contractor/WCSD will present their careers, including roles and responsibilities. Teachers can go to subject tables for a 10–15-minute presentation. Staff will connect these learning opportunities to their content standards and collaborate to generate a list of possible student activities to take place during the design/construction process.	1 - 1.5 hours
Café meeting # 2 Meeting to plan with contractors/sub-	Design consultants 1-2 staff Contractor 1-2 staff Sub- contractors 1-2 staff	Members of the Design and construction team will meet with staff to continue to	1-1.5 hours

contractors and teaching staff to finalize lessons and activities, identify dates for lessons, and determine additional resources needed.	WCSD Cap. Projects 1-2 staff WCSD Student Advisory 1-2 staff Interested STEAM teaching staff and school leadership	develop implementation of student activities and or establish a collection of ongoing STEAM engagements, presentation, teaching opportunities, tours, and references to building design/construction to be used annually as teaching tools for integrated curriculum.	
Student Activity/Lesson: These activities/lessons may be prepared collaboratively with the contractor, sub-contractors, engineers, Architect, and the teaching staff. These activities/lessons can be taught directly to students utilizing the teaching staff and or experts within the design & construction field.	Design team, construction team, Capital Projects, student advisory, teaching staff as required and appropriate for identified activities.		Depends on grade level & or activity. Learning activities could be a single event, or occur weekly, or monthly. Steam process could continue over multiple years or the process could restart annually if needed or requested by the school due to new staff & students.

GEOTECHNICAL SITE ASSESSMENT
LIBBY BOOTH ELEMENTARY SCHOOL MODERNIZATION
STEAM AND THE MEDIA CENTER/LIBRARY
RENO, WASHOE COUNTY, NEVADA



CME CONSTRUCTION MATERIALS ENGINEERS, INC.

PREPARED FOR:

Washoe County School District

MARCH 2026
FILE: 4104

CME CONSTRUCTION MATERIALS ENGINEERS, INC.
300 Sierra Manor Drive, Suite 1
Reno, NV 89511

March 3, 2026
File: 4104

Washoe County School District
Teresa Poulsen
Director, Planning & Design
WCSD Capital Projects
14101 Old Virginia Road
Reno, Nevada 89521-8912

RE: Geotechnical Site Assessment
Libby Booth Elementary School Modernization
STEAM and The Media Center/Library
1450 Stewart Street
Reno, Washoe County, Nevada

Dear Ms. Poulsen:

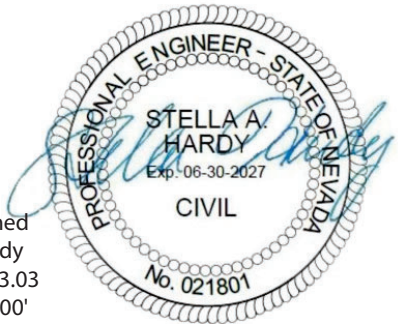
Construction Materials Engineers Inc. (CME) is pleased to submit our geotechnical site assessment for the proposed Libby Booth Elementary School Modernization STEAM and The Media Center/Library project to be constructed at 1450 Stewart Street, in Reno, Washoe County, Nevada.

The following report includes the results of our subsurface investigation, laboratory testing, engineering analyses, and presents our recommendations for the design and construction of the project. We thank you for the opportunity to provide our services and look forward to working on future endeavors together.

Please feel free to call us should you have any questions or require additional information.

Sincerely,

CONSTRUCTION MATERIALS ENGINEERS, INC.



Stella Hardy
Digitally signed by Stella Hardy
Date: 2026.03.03 16:15:42 -08'00'

Date Signed: 03/03/2026

Stella A. Hardy, PE
Geotechnical Project Manager
RE. Number: 21801
Expires: 06/30/2027
shardy@cmenv.com
Direct: 775-737-7569

Carolyn J. Jones, PE
Project Engineer
cjones@cmenv.com
Direct: 775-737-7573
Cell: 775-376-2196

SAH:CJJ:cjj
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GEOTECHNICAL SITE ASSESSMENT
Libby Booth Elementary School Modernization
STEAM and The Media Center/Library
1450 Stewart Street
Reno, Washoe County, Nevada

1.0 INTRODUCTION

Presented herein are the results of Construction Materials Engineers, Inc.'s (CME) geotechnical investigation performed for the proposed Libby Booth Elementary School Modernization STEAM and The Media Center/Library project to be constructed at the southwest corner of the campus in Reno, Washoe County, Nevada. The general vicinity of the campus is shown on Figure 1.

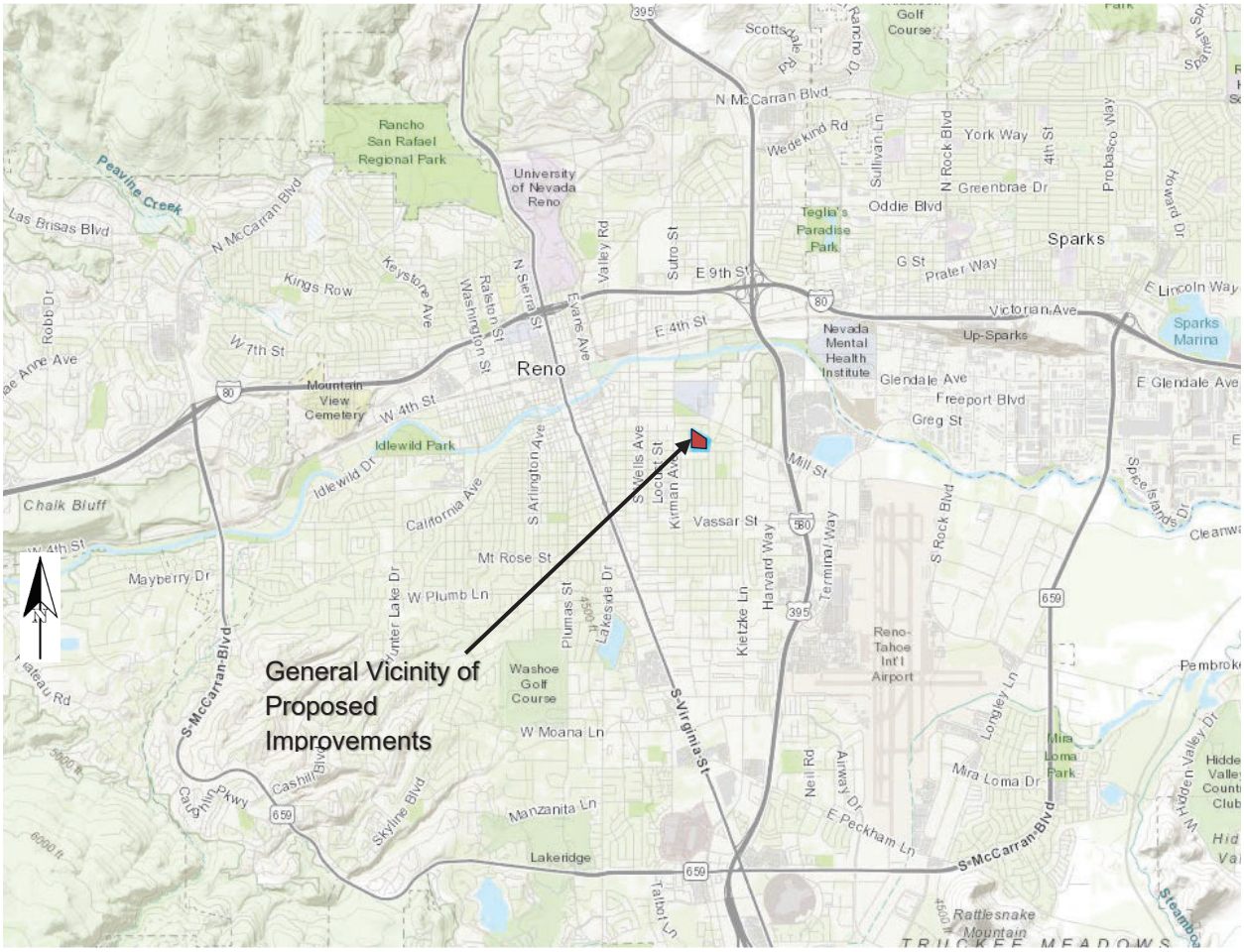


Figure 1: General Project Vicinity

The primary objectives of this study were to:

1. Investigate the general geologic profile and groundwater conditions at the subject site; and
2. Provide geotechnical recommendations for the design and construction of the project as currently proposed.

Results of the subsurface investigation, laboratory analysis, and details of the project as described in this report, form the basis for engineering analyses performed, conclusions, and geotechnical recommendations contained herein.

2.0 PROJECT DESCRIPTION AND SITE CONDITIONS

2.1 PROJECT DESCRIPTION

The STEAM and The Media Center/Library project includes a one-story stand-alone structure, with a footprint of nearly 5,000 square feet within the southwestern portion of the existing playground area. At the time of this report, the project was in the preliminary planning phase, planned improvements are expected to include:

- Construction of a new campus building:
  - **Structural Design**: The new structure will be supported using conventional shallow spread footings with concrete slab-on-grade. The foundation will include continuous spread footings along load-bearing walls and/or isolated column footings to support concentrated loads.
  - **Structural Loading**: Assumed maximum structural loads for design purposes include:
    - 1 to 6 kips per linear foot for continuous spread footings,
    - Up to 60 kips for isolated column footings, and
    - 100 to 200 pounds per square foot for interior slabs.
  - **Site Grading**: Cuts and fills of up to 2 feet may be required to create a level building pad and promote positive drainage
- Appurtenant construction will include ADA access improvements, sidewalks, and subsurface utilities.

The proposed site layout is presented as Figure 2.



Figure 2: Site Plan (Provided by Washoe County School District[1])

[1] Odyssey Engineering, Inc., & H+K Architects. (2026, January). *Libby Booth Elementary School Modernization – Preliminary Site Exhibit* (Preliminary, not for construction). Washoe County School District.

2.2 EXISTING SITE CONDITIONS



Photo 1: Looking East in the Vicinity of the Future Building Pad

Libby Booth Elementary School is situated on an approximate 6.6-acre, irregularly shaped parcel. The campus is bounded by Stewart Street to the north, Yori Avenue to the east, Roberts Street to the south, and residential development to the west.

The site is currently developed with the main school buildings and associated parking areas located in the eastern portion of the parcel. Paved athletic pads, playground areas, and open unpaved play space occupy the western portion of the campus.

Site topography slopes gently across the property with an overall elevation difference across the 6.6-acre site of approximately 10 feet. Irrigated landscaping is localized to the northern and eastern limits of the site near the school buildings and consists primarily of irrigated grass and scattered trees. The proposed improvement area is located in the southwest portion of the campus, outside the irrigated landscape zone, within an existing fill-covered dirt play area.



Google Earth Street View 1: Looking Northwest From Roberts Street at the Proposed Improvement Area

3.0 SUBSURFACE EXPLORATION

3.1 EXPLORATORY BORINGS

On January 19th, 2026, two (2) vertical test borings were drilled using a truck-mounted Diedrich 120 drill rig equipped with an automatic hammer. Soil samples were collected using the following methods:

Drilling Methods	The drilling methods included hollow-stem auger for soil exploration to the depth of termination.
Soil Sampling	Soils were sampled in-place at 2½-foot intervals using the following sampler types: • **SPT Sampler** – Unlined split-spoon drive samplers with an outside diameter of 2.0 inches, an inner shoe diameter of 1.4 inches, and an upset wall design. • **California Modified Sampler** – Split-spoon drive samplers with an outside diameter of 3.0 inches and an inner shoe diameter of 2.4 inches; samplers may be either lined or unlined. • **Bulk Samples** – Collected by hand from drill cuttings at the ground surface corresponding to specific sample intervals. Soil samplers were driven by a standard 140-pound drive hammer with a 30-inch stroke, and blow counts (N_{field}) were recorded for respective drive sample intervals[2]. Blow counts presented on the logs are uncorrected.
Soil Classification	CME personnel visually examined and classified the materials in general accordance with ASTM D2488. Where applicable, material classifications were subsequently updated based on laboratory testing in general accordance with ASTM D2487. The Unified Soil Classification System (USCS) chart is provided as Plate A-3.



The borings were advanced to depths of up to 15 feet below the existing ground surface (bgs). In Boring B-26-01, at a depth of approximately 0.5 feet bgs, heavy grinding was encountered due to oversized rock particles (e.g., cobbles and boulders). The borehole was relocated approximately 3 feet to the west, and drilling was then continued.

Photograph 1: Looking West at Boring B-2

[2] The number of blows to drive the sampler for the final 12 inches of an 18-inch penetration into undisturbed soil is an indication of the density and consistency of the material (Standard Penetration Test (SPT) - ASTM D1586). Boring logs indicate the type of sampler used for each boring and sample.

3.2 GEOPHYSICAL MEASUREMENTS

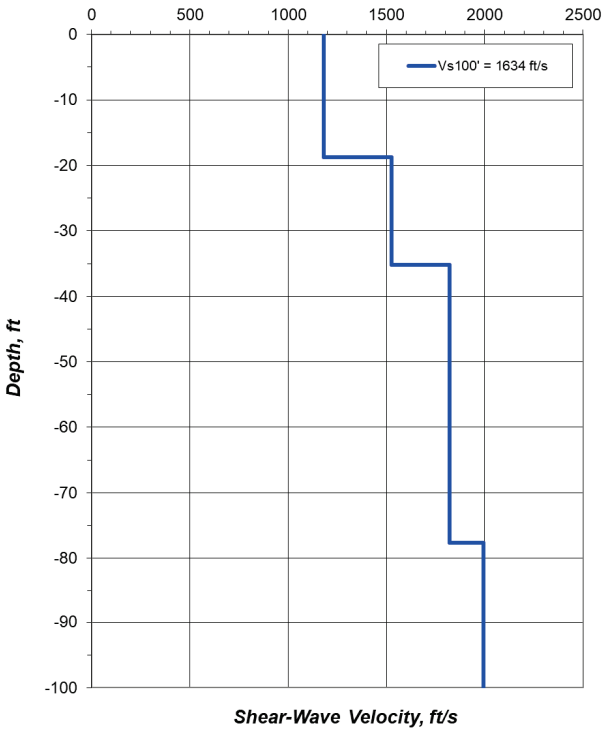


Figure 3: Shear Wave Velocity Profile

One shear wave velocity measurement was performed using Refraction Microtremor (ReMi). The DAQlink 4 24-bit acquisition system (Seismic Source/Optim) utilizing a multichannel geophone cable with twelve (12) geophones, placed at an approximate spacing of 25 feet, was used to obtain surface wave data.

Vertical geophones with resonant frequencies of 10 Hz measure surface wave energy from broad band ambient site noise across the geophone array (i.e., ReMi setup location) for multiple 30-second iterations.

The resulting 1-dimensional shear wave velocity model is included as Figure 3 .

The $Vs_{100'}$ represents the average shear wave velocity profile based on travel time from the ground surface to a depth of 100 feet at the tested location. Based on the ReMi data, the average $Vs_{100'}$ for the site is about 1,634 feet per second (ft/s).

The shear-wave velocity profile is generally classified by ASCE 7-22 as Site Class C, very dense sand or hard clay (1,450 to 2,100).

4.0 LABORATORY TESTING

Soils testing performed in CME's laboratory was conducted in general accordance with ASTM standards and methodologies. Representative soil types were selected and analyzed to determine index properties and engineering properties. The following laboratory tests were completed as part of this investigation:

- In-situ moisture content (ASTM D 2216)
- Grain size distribution (ASTM D6913)
- Atterberg Limits (ASTM D4318)

In addition, our firm contracted with an outside laboratory to complete the following analytical testing for the corrosion potential of the site soils:

- Soluble Sulfates (ASTM C1580)

4.1 SOIL INDEX TEST SUMMARY AND SHRINK/SWELL POTENTIAL

Table 1 provides a general summary of the laboratory index testing completed to date.

Table 1: Index Test Summary

Ex. ID	Sample ID	Sample Depth (ft to ft)	Moisture Content (%)	Plasticity Index [PI]	Liquid Limit [LL]	%Passing No. 40	%Passing No. 200	ASTM Soil Classification
B-26-01	Bulk	0.0-5.0	6.2	10	24	30	18.1	SC
	1B	5.0-6.5	11.8	NP	NV	72	24.9	SM
	1D	10.0-11.5	3.3	-	-	37.5	14.1	SM
B-26-02	Bulk	0.0-5.0	7.8	2	21	40	21.4	SM
	2B&2C	5.0-6.5 7.5-9.0	-	6	31	-	-	SM
	2E	12.5-14.0	11.0	-	-	15.5	7.2	GP

NOTES:

1. Generalized guideline for determining potential for shrink/swell soil based on plasticity index (PI), and liquid limit (LL) is included below:

Shrink/Swell Potential	Plasticity Index	Liquid Limit
Very Low	PI<15	LL<35
Low to Moderate	15<PI<25	35<LL<45
Moderate to High	25<PI<35	45<LL<50
High to Very High	PI>35	LL>50

Measured plasticity indices range from nonplastic (NP) to a maximum of 10, and liquid limits are all below 35 where tested. Based on the resulting index properties and the observed soil conditions, the onsite materials exhibit very low shrink/swell potential.

5.0 SUBSURFACE CONDITIONS

5.1 GEOLOGY

Based on our review of the *Preliminary Revised Geologic Maps of the Reno Urban Area, Nevada* (Ramelli, A.R., et al., 2011), the project site is mapped within younger and older Tahoe-aged Truckee River fluvial deposits (Qrt). Donner Lake-aged Truckee River fluvial deposits (Qrd) are mapped immediately west of the site. An excerpt of the referenced geologic map is included as Figure 4 below:

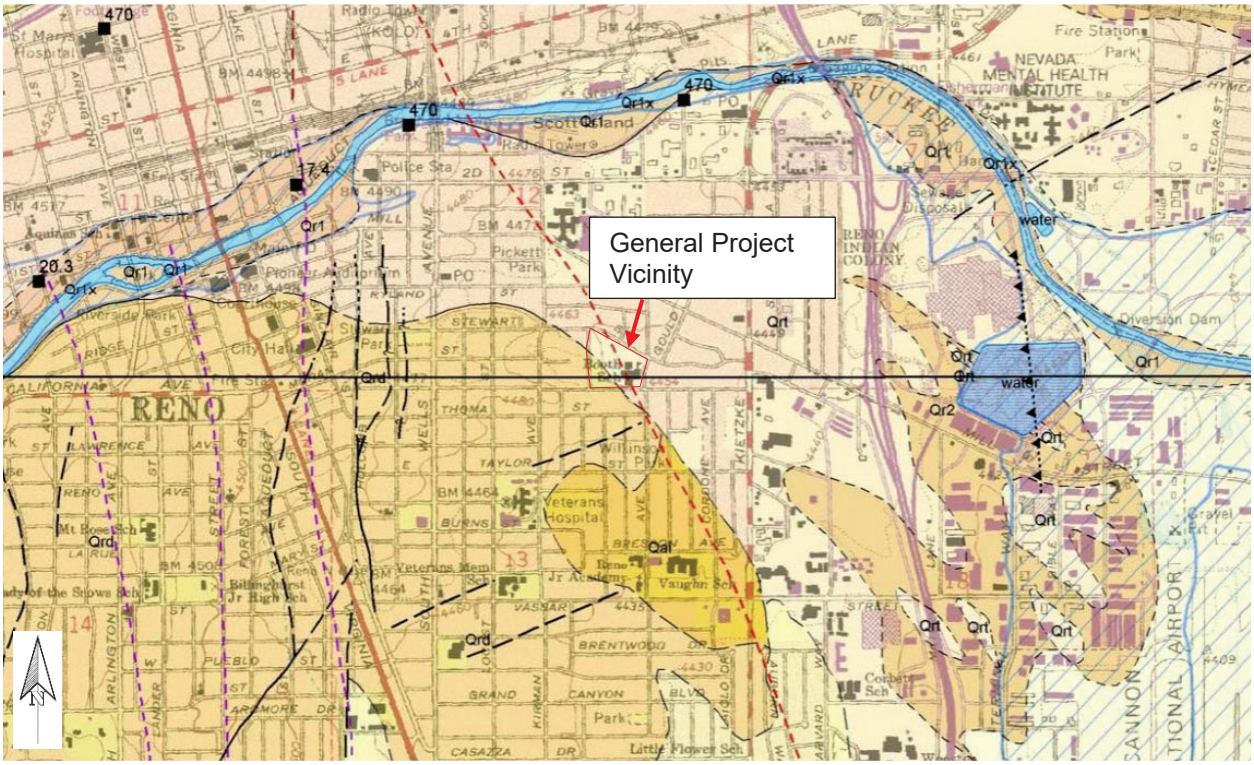


Figure 4: Geologic Map

The mapped geology suggests that native onsite material will be predominantly coarse grained granular soil with gravel, cobble, and occasional boulder sized fragments. Within the older Donner Lake–aged unit, localized *argillic* (clay-enriched) horizons overlying denser coarse-grained soil may be present.

The NRCS Web Soil Survey maps the site as Washoe gravelly sandy loam, which is described as mixed alluvium ranging from gravelly sandy loam to stratified gravelly loamy coarse sand to very cobbly loamy coarse sand, which is generally consistent with the mapped fluvial deposits.

5.2 GENERALIZED SUBSURFACE PROFILE

The subsurface profile at the subject site includes a thin upper layer of undocumented fill consisting of playground sand classifying as poorly graded sand with silt (SP-SM), observed to extend approximately 2 to 3 inches below the ground surface. Beneath this surficial material, the subsurface profile primarily consists of interbedded silty sand with gravel and cobbles (SM), silty sand (SM), clayey gravel with sand (GC), and poorly graded gravel with sand (GP). The materials are predominantly granular with varying amounts of gravel, cobbles, and non-plastic to low-plasticity fines.

5.3 GROUNDWATER AND SOIL MOISTURE

Groundwater was not encountered during the current exploration to the maximum depth explored. Based on the anticipated depth of excavation required for the development, groundwater is not expected to impact construction. Based on nearby well log data, static groundwater levels are anticipated to lie at depths greater than 15 feet and up to 30 feet below existing ground surface.

Seasonal seepage and/or runoff may be encountered depending on the season of construction and cumulative precipitation in the area. Temporary dewatering of opencut excavations affected by seasonal runoff may be required and shall be performed by the contractor. Construction planning shall include the assumption that groundwater fluctuations may occur due to precipitation, temperature, runoff, adjacent irrigation, or where conduits such as utility trenches are present. Regardless of the conditions encountered during the current exploration, CME recommends the contractor be prepared for dewatering during construction.

6.0 SEISMICITY AND FAULTING

6.1 SEISMICITY



Figure 5: Overview Map Showing the Basin and Range Physiographic Province

The western United States is a region of moderate to high seismicity related to crustal deformation associated with plate tectonics. Outside of Alaska, the most seismically active regions include coastal California along the San Andreas fault system and the Wasatch Front in Utah. The Wasatch Front forms the eastern boundary of the Basin and Range physiographic province, while the eastern front of the Sierra Nevada marks the western margin of the province. The STEAM and The Media Center/Library project is located within the western portion of the Basin and Range, a tectonically active region characterized by crustal extension and active faulting.

Nevada has a well-documented history of significant earthquakes, including several twentieth-century events exceeding magnitude 7, reflecting active crustal deformation associated with the Walker Lane and Basin and Range transition (Trugman et al., 2024). The Reno–Tahoe–Carson City region lies within the Walker Lane tectonic zone and is therefore subject to elevated regional seismic hazard (SCEC, 2020).

6.2 FAULTING

To determine the location of mapped earthquake faulting trending through or near the project site, a review of the following published information was completed:

1. USGS Website: *Earthquake Hazards Program Quaternary Faults in Google Earth*;
2. The USGS Interactive Fault Map U.S. Quaternary Faults (arcgis.com); and
3. University of Nevada Reno Interactive Quaternary Fault Map included as Figure 6 (http://gisweb.unr.edu/QuaternaryFaults/)

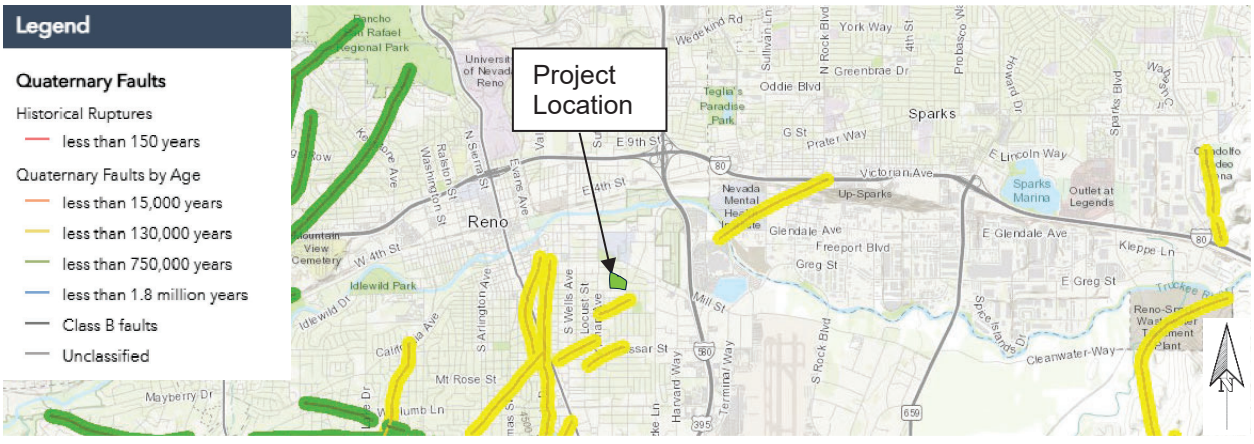


Figure 6: Excerpt from the UNR Quaternary Interactive Fault Map

10 ka	130 ka	750 ka	<1.8Ma
Holocene Active	Late Quaternary Active	Quaternary Active	Quaternary

ka = 1,000 years in the past; Ma = 1,000,000 years in the past

The Quaternary earthquake fault evaluation criteria were established by a professional committee for the State of Nevada Seismic Safety Council in 2006, as outlined above. Faults with more recent activity (e.g., Holocene-active faults) present a higher potential for surface rupture hazards.

No mapped faults are located traversing directly through the project site. The closest mapped fault to the site is located approximately 0.2 of a mile south/southeast of the project location. This fault is northwest to southeast trending associated with the Mount Rose fault zone and is late Quaternary Active.

6.3 LIQUEFACTION HAZARD

Liquefaction is defined as a loss of shear strength in saturated soils resulting from cyclic loading during earthquake-induced ground motion. The phenomenon occurs when cyclic shear stresses induce excess pore water pressure between soil grains, leading to a temporary loss of effective stress and subsequent seismically induced settlement or deformation.

Liquefaction is typically limited to non-plastic or low-plasticity soils (i.e., PI < 7). The soil types most susceptible include:

- Loose to medium dense cohesionless sands,
- Soft to stiff non-plastic to low-plastic silts, and
- Mixed silt to sandy soils located below the groundwater table.

A formal liquefaction hazard analysis based on SPT blow counts was not performed for this project due to the shallow depth of subsurface exploration and the limited soil profile encountered. To supplement the exploration data, a shear-wave velocity (Vs) based screening analysis was performed to evaluate the potential for liquefaction hazards at the site. This screening was conducted in general accordance with the procedure presented in *A New Vs-Based Liquefaction-Triggering Procedure for Gravelly Soils* (Rollins et al., 2022).

These methods provide a probabilistic framework for assessing liquefaction triggering based on shear-wave velocity and cyclic stress ratio. The risk levels are summarized as follows:

Estimated Probability of Liquefaction	Risk Level	Engineering Interpretation
≤ 5%	No Risk to Very Low	Liquefaction is unlikely; mitigation or further evaluation not typically required
> 5% – 15%	Low Risk	Possible liquefaction under extreme or rare loading, typically no further evaluation required
> 15% – 35%	Moderate Risk	Potential for triggering; may require further evaluation
> 35%	High Risk	High likelihood; mitigation or redesign is generally needed

For this evaluation, a groundwater elevation of approximately 20 feet below grade and a design earthquake moment magnitude of 6.7 were assumed.

Based on the subsurface conditions encountered, measured shear-wave velocity data (see Section 3.2), and the analysis summarized in Appendix D, the probability of liquefaction at the site is considered **no risk to very low risk**. Accordingly, no additional liquefaction evaluation or mitigation is considered necessary for the project.

7.0 DISCUSSION

7.1 GENERAL INFORMATION

The following definitions and standards are applicable for recommendations in this report related to design and construction of the proposed project:

Table 2: General Definitions for Report Recommendations	
Relevant Codes and Specifications	• 2024 International Building Code (IBC) • ASCE/SEI 7-22, Minimum Design Loads and Associated Criteria for Buildings and Other Structures • 2012 Standard Specifications for Public Works Construction, Revision 8 (SSPWC)
Onsite Soil Definition (For the Purposes of This Report)	
Fine Grained Soil	Soil with: • More than 35% by weight passing the No. 200 sieve, and • Plasticity Index (PI) < 15 or Expansion Index (EI) < 20.
Clay Soil	Soil with: • More than 15% by weight passing the No. 200 sieve, and • PI ≥ 15 or EI > 20.
Granular Soil	Soil not meeting the definitions of fine-grained or clay, with: • Maximum particle size ≤ 4 inches, • Less than 30% retained on the ¾-inch sieve, • Less than 35% passing the No. 200 sieve, and • PI < 15 or EI < 20.
Undocumented Fill	Soil/material placed and/or compacted but not observed, monitored, tested, or documented by a licensed materials test engineering firm. This material may be suitable for re-use pending further verification with the use of laboratory testing.
Mass Grading and Site Work (For the Purposes of This Report)	
Aggregate Base	Where referenced in this report, aggregate base shall consist of Type 2, Class B conforming to Section 200.01.03 or 200.01.04 Type 1 Recycled Base of the SSPWC.
Structural Fill	Structural fill shall comply with the following: • **Onsite Soil:** Soil generated from onsite grading may be reused as structural fill provided it meets the requirements of granular soil, screened to removed oversize particles, free of organics and deleterious materials. • **Imported Fill:** Imported structural fill shall meet the requirements described in Section 9.2 of this report.
Structural Areas	Includes all areas intended to support: • Concrete slabs-on-grade and flatwork, • Building or structure foundations, • Utility installations; and • Pavements.

Table 2 (Continued): General Definitions for Report Recommendations	
Subgrade	Subgrade is defined as: • The elevation directly beneath concrete or asphalt pavement structural sections; • The bottom of excavations for foundations bottomed on native soil or fill; and • The native soil surface elevation beneath placed fill.
Relative Compaction and Optimum Moisture Content	The dry density of soil after field compaction, expressed as a percentage of the maximum dry density per ASTM D1557 (Modified Proctor). Optimum moisture content is the water content at which that maximum dry density occurs.

7.2 GEOTECHNICAL CONSIDERATIONS

Based on the results of our field and laboratory studies, the proposed project as described in this report may be constructed provided the recommendations in this report are adhered to. Table 3 provides a general summary of the construction considerations as they pertain to the project. Geotechnical recommendations for design and construction of the project are included as Section 8.0 and Section 9.0.

Table 3: Geotechnical Considerations and Overview Summary	
Groundwater/ Seasonal Runoff	Groundwater was not encountered during the subsurface exploration and is anticipated to occur at depths greater than the proposed improvements. However, seasonal runoff, perched water, or prolonged landscape irrigation adjacent to the improvements may create nuisance water conditions within the project limits. The contractor should be prepared to address localized wet or saturated soils during grading, trenching, or excavation activities.
Undocumented Fill	A thin layer of granular undocumented fill (e.g., playground sand) was observed at the ground surface within the playground area. The site is currently developed, and additional undocumented fill may be present, although it was not encountered in the borings. If undocumented fill is encountered during construction, we recommend it be removed and replaced with properly compacted structural fill. If thicker zones of undocumented fill are encountered, our office should be notified so that the material can be evaluated and appropriate remedial earthwork recommendations can be provided.
Reuse of Onsite Materials	Materials encountered during the subsurface exploration generally meet the definition of a granular soil and may be reused as structural fill, provided that oversized cobble- to boulder-sized fragments are removed prior to placement.
General Information	This report shall be reviewed by the design team and contractor in its entirety. The geotechnical recommendations provided herein shall be incorporated into the project design and implemented during construction. If clarification or additional information is needed, the geotechnical consultant should be contacted prior to proceeding with the work.

8.0 DESIGN RECOMMENDATIONS

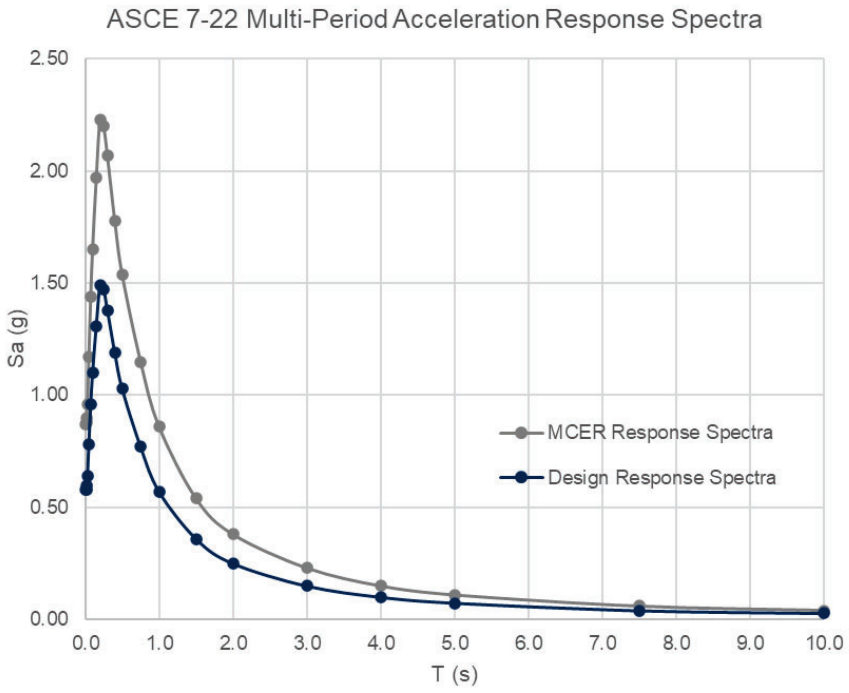
8.1 SEISMIC DESIGN PARAMETERS

Based on the one-dimensional shear wave velocity profile obtained from the ReMi survey, a Site Class C is appropriate for the project design. Table 4 presents the acceleration response spectra for both the MCER and design ground motions for the project site. A copy of the Seismic Hazards Report is provided in Appendix C.

Table 4: Seismic Design Parameters (2024 IBC)

Latitude	Longitude	Method for Determining $V_{s(100)}$	$V_{s(100)}$ (ft/s)	Risk Category	Seismic Design Category	Site Class
39.520437	-119.79548	ReMi	1,634	III	D	C

T (s)	Sa(g)	
	MCE_R	Design
0.00	0.87	0.58
0.01	0.88	0.58
0.02	0.90	0.60
0.03	0.96	0.64
0.05	1.17	0.78
0.08	1.44	0.96
0.10	1.65	1.10
0.15	1.97	1.31
0.20	2.23	1.49
0.25	2.20	1.47
0.30	2.07	1.38
0.40	1.78	1.19
0.50	1.54	1.03
0.75	1.15	0.77
1.0	0.86	0.57
1.5	0.54	0.36
2.0	0.38	0.25
3.0	0.23	0.15
4.0	0.15	0.10
5.0	0.11	0.07
7.5	0.06	0.04
10.0	0.04	0.03



NOTES:
1. See requirements for Site Specific Ground Motion Procedures in ASCE 7-22 Section 11.4.7.
2. Reference https://ascehazardtool.org/

8.2 FOUNDATION DESIGN

Based on the assumed structural loading, proposed structure type, and soil conditions encountered during the subsurface exploration, foundation design parameters presented in Table 5 (Allowable Bearing Pressure) are recommended for project design.

Table 5: Allowable Bearing Pressure	
Allowable Bearing Pressures (psf)	
Footings bottomed at least 2 feet [(3)] below the proposed finished grade elevation on compacted structural fill or native granular soil	3,500
Allowable Friction Coefficient:	
For Cast-In-Place Concrete Foundations bottomed on structural fill or native granular soil	0.45
For Precast Concrete Foundations bottomed on structural fill or native granular soil	0.36
Allowable Passive Soil Pressure (psf/ft)	
Backfill soils consisting of compacted onsite granular soil or structural fill	295

NOTES:

1. Units:
   a. (psf): Pounds per square foot.
   b. (psf/ft): Pounds per foot of depth
2. Allowable Bearing Pressure:
   a. May be increased by one-third for total loading conditions, including wind and seismic forces.
   b. Is a net value, and the weight of the foundation extending below grade and backfill may be neglected when computing dead loads.
   c. Includes a minimum Factor of Safety (FOS) of 3.0 against bearing failure.
3. Minimum Foundation Width:
   a. The design is based on a minimum foundation width of 1 foot.
   b. Foundations shall be proportioned and located to maintain stability (e.g., bearing, overturning, sliding, uplift, eccentricity). Eccentric loading, where required, shall be evaluated for allowable bearing pressures.
   c. Overturning moments and uplift loading can be resisted by the weight of the foundation, weight of the structure, and any soil overlying the foundation.
4. Frost Protection for Footings:
   a. For frost protection, footings shall be set at least 2 feet below the adjacent exterior grade unless otherwise designed to resist uplift due to frost heave (e.g., PT slabs).
   b. Alternatively, foundations may be placed on non-frost susceptible material as defined in Section 4.2 (Foundations on Non-Frost Susceptible Ground or Fill Material) in ASCE 32. This non-frost susceptible material must extend below the jurisdictional frost line.
5. Passive Earth Pressure:
   a. The passive earth pressure is used as a triangular distribution.
   b. Frictional resistance and passive earth pressure provided in the table are "allowable" and can be used in combination without reduction. A factor of safety of 1.5 was applied.
   c. The material within the frost zone shall be neglected when designing for passive pressure.
   d. When sloping backfill is used near foundations, the design engineer shall contact the geotechnical engineer for additional recommendations.
   e. Lateral loads (such as wind or seismic) may be resisted by passive soil pressure and friction at the bottom of the footing.
6. Backfill Compaction:
   a. Assumes stem-wall backfill is compacted to at least 90 percent relative compaction (ASTM D1557).
7. Foundation Excavation Bottom:
   a. The bottom of all foundation excavations shall be free of ponded or standing water, frost, and loose or sloughing materials.
   b. CME recommends that footing excavations be observed by the project soils engineer prior to placing concrete reinforcing steel to confirm the subsurface conditions are similar to those described in this report.

8.2.1 ESTIMATED SETTLEMENT OF SHALLOW FOUNDATIONS

An elastic settlement response is expected for foundations bearing on compacted structural fill or native, medium-dense to dense granular soils. Most settlement is anticipated to occur quickly, generally within the construction timeframe.

Design structural loading and the proposed foundation layout were not available at the time this report was prepared. Once loading information is provided, settlement estimates can be refined. However, based on the assumed structural loads presented in Section 2.1, total static settlement is estimated to be about 1 inch or less. Differential settlement is anticipated to be on the order of one-half of the total settlement, provided foundations are supported on similar bearing materials (e.g., densified structural fill or native cut) and that differential fill thickness beneath the structure pad is less than 5 feet.

Localized increases in settlement may occur where foundations experience eccentric loading, significant load redistribution, or non-uniform contact pressures. If such load conditions are expected please contact our office to confirm settlement estimates presented in this section.

8.3 STATIC LATERAL EARTH PRESSURES

Static lateral earth pressures are dependent on the relative rigidity, allowable movement of the retaining structure, strength properties of the backfill soil, and drainage conditions behind the retaining wall. The lateral earth pressure is strongly dependent on the lateral deformations which occur in the soil.

Backfill Soil	For the purpose of estimating active and passive lateral earth pressures, the following soil parameters were assumed:
	• Backfill Type: Onsite granular soil, imported structural fill, or aggregate base.
	• Backfill Zone: Backfill material shall extend laterally behind the wall a distance at least equal to the retained height of the soil.
	• Compaction Requirement: Backfill shall be compacted to at least 90 percent (%) relative compaction (per ASTM D1557)
	• Estimated soil properties:
	  ○ Unit Weight (Active Pressure): 125 pcf
	  ○ Internal Friction Angle: Minimum 34°
	  ○ Cohesion: 0 psf

Wall Displacement and Earth Pressure Condition	A restrained retaining structure (i.e., displacement not permitted) will experience higher lateral earth pressures than a retaining structure that is free to move (cantilever conditions):
	• A non-yielding or restrained retaining structure cannot rotate sufficiently and therefore shall be designed based on the at-rest earth pressure (Ko),
	• For a yielding retaining structure that can rotate with the ability to deflect at the top of the wall, the following apply:
	  ○ Wall movement greater than $0.001H^3$ for granular backfill are required to mobilize active earth pressure (Ka); and
	  ○ Full mobilization of the passive earth pressure coefficient (K_p) typically requires outward wall movement on the order of 0.01H (1% of the wall height) within granular backfill. For restrained (non-yielding) walls, such movements may not be compatible with structural or serviceability criteria. Accordingly, any reliance on passive resistance in design should be evaluated by the structural engineer of record to determine whether the required displacement can be tolerated for the intended structure.

Static lateral earth pressure values are presented in Table 6.

Table 6: Static Lateral Earth Pressures

Earth Pressure Condition	Backfill Slope	Toe Slope	Wall Type	Earth Pressure Coefficient	Equivalent Fluid Weight (psf/ft)
Active (P_a)	Level	N/A	Yielding	0.28(k_a)	35
At-Rest (P_o)	Level	N/A	Non-Yielding	0.44 (k_o)	55
Passive (P_p)	N/A	Level	Refer to Table 5		

NOTES:
1. All pressures are in pounds per square foot per foot of depth (psf/ft).
2. Surcharge and dynamic (seismic) loads are not included, if wall heights will exceed 6 feet retained, please contact our office for additional guidance.
3. Assumes free draining backfill and no hydrostatic pressure.

[3] Where H is wall height

9.0 CONSTRUCTION RECOMMENDATIONS

9.1 SITE PREPARATION

9.1.1 CLEARING AND DEMOLITION

Stripping and Grubbing	Wood chips confined by plastic borders beneath existing play structures should be completely removed, including any underlying geotextile or separator fabric. This material is not suitable for reuse onsite and should not be incorporated into structural fill or backfill. Based on our understanding of the proposed building layout, the footprint is generally devoid of vegetation. If present within improvement areas, surface vegetation, duff, and topsoil should be stripped and grubbed prior to initiating fill placement or construction activities. Vegetation should be disposed of outside the construction limits of the site. Topsoil may be stockpiled onsite for later use in non-structural landscaped areas. Stripped and grubbed materials should not be incorporated into or permitted for use as structural fill.
Playground Sand	The upper approximately 2 to 3 inches of the site consists of imported playground sand. Playground sand should be completely removed in areas of proposed buildings, slabs, pavements, utilities, and other structural improvements. Playground sand may be reused as structural fill provided it is free of deleterious materials, fabric, and debris, and is moisture conditioned and compacted in accordance with the structural fill requirements of this report.
Demolition	Existing pavement, concrete, and manmade structures, including play equipment foundations, should be demolished and removed within areas of proposed improvements. Demolition debris should be removed from the site. Voids created by demolition should be cleaned of loose material, widened as necessary to permit access for compaction equipment, and backfilled with structural fill.

9.1.2 SUBGRADE PREPARATION

Scarification and Moisture Conditioning	Scarification and moisture conditioning shall include uniform mixing of soil to achieve recommended moisture contents . The moisture content of the in-situ soil shall be determined during construction to evaluate if moisture conditioning is required. Moisture conditioning and scarification depth will be dependent on the soil type: • Where coarse-grained soils contain nested cobbles or boulders larger than about 6 inches in nominal diameter, scarification is not required. The exposed subgrade should be cleaned of loose or sloughing material and confirmed during proof rolling to be firm, stable, and unyielding prior to fill placement. • Granular soils with particle sizes generally 3 inches or less shall be scarified to a depth of about 8 inches, moisture conditioned to within ±2 percent of optimum moisture, and compacted prior to fill placement. Moisture contents up to about +3 percent above optimum may be acceptable provided the soil remains stable under construction equipment and the required density can be achieved in subsequent lifts. • Clay subgrade soils shall be scarified to a depth of about 12 inches, moisture conditioned to within +2 to +4 percent above optimum moisture prior to compaction. This moisture condition shall be maintained by periodic surface wetting or other approved methods until the surface is covered by at least one lift of fill.
Compaction	Scarified material shall be compacted to at least 90 percent relative compaction (ASTM D1557). After the compaction process, a firm, stable surface shall be produced. Compaction of the subgrade soil will be dependent on soil type: • Granular soil is not considered cohesive and the particles generally require shaking or vibratory action (i.e., smooth drum roller) for densification. • Clay soil is considered cohesive and particles are best densified using high impact ram or sheepsfoot roller compactors.
Addressing Subgrade Instability	To assess the potential for subgrade pumping or instability, the prepared surface should be proof rolled using heavy, rubber-tired construction equipment, such as a fully loaded water truck. The contractor is responsible for maintaining subgrade stability throughout construction. Given the generally granular nature of the onsite soils, any instability encountered is expected to be localized. Localized soft or pumping areas should be overexcavated and replaced with properly moisture-conditioned aggregate base or structural fill. If instability is more widespread, CME should be notified to provide additional evaluation and recommendations. If subgrade soils become saturated during construction, the potential for instability increases significantly. The contractor should protect exposed subgrade areas from stormwater and precipitation using plastic sheeting, tarpaulins, or other waterproof coverings. Saturated or ponded areas are unsuitable for compaction or field density testing due to moisture contents exceeding the acceptable range specified in this report.

9.2 STRUCTURAL FILL

Material generated onsite that is proposed for reuse as structural fill shall meet the requirements of a granular soil as defined in Section 7.1 (General Information). Structural fill shall be free of vegetation, organic matter, and other deleterious material.

Imported structural fill, if required, shall comply with the specifications presented in Table 7 (Guideline Specification for Imported Structural Fill).

Table 7: Guideline Specification for Imported Structural Fill

Sieve Size	Percent by Dry Weight Passing
4-inches	100
¾ inch	70 – 100
No. 40	15 – 65

Percent Passing No. 200	Maximum Liquid Limit	Maximum Plastic Index
5 – 15	45	14
16 – 35	40	10

R-Value (Traffic Areas Only)	Water Soluble Sulfate (SO_4) in Soil (%) by Mass	Organic Content (ASTM D2974) (%)
30	<0.2	<3%

NOTES:
1. R-Value is required for materials placed in roadways or areas to receive vehicular traffic only. Not required for building foundations or ancillary improvements outside of traffic areas.
2. Water Soluble Sulfate required where structural fill will be located adjacent to, above, or in direct contact with concrete elements. Please contact the project geotechnical engineer for additional guidance.

9.2.1 PLACEMENT

Placement of structural fill shall comply with the following:

Moisture Content Requirements	• Prior to compaction, soils shall be moisture conditioned to within ±2 percent of optimum moisture. • Moisture contents exceeding +2 percent above optimum are acceptable provided the material remains stable and the required relative compaction can be achieved within the lift and in subsequent lifts.
Lift Thickness and Densification	• Structural fill shall be placed in level lifts not exceeding 8 inches in loose thickness. • Each lift shall be compacted to a minimum of 90% relative compaction.
Grading Restrictions	Structural fill shall not be placed: 1. When fill material is frozen. 2. On frozen or unstable subgrade soils. 3. In areas where ponded water is present.

9.3 TRENCHING & CONFINED EXCAVATIONS

9.3.1 TRENCH STABILITY

All excavations regardless of depth shall be evaluated for stability including scaling trench walls to remove loose material prior to occupation by construction personnel. Shoring or sloping of trench walls may be required to protect construction personnel and provide temporary stability. In areas where temporary confined excavations may be unstable, trench boxes may be used to provide safe ingress and egress for construction personnel.

Excavations shall comply with current OSHA safety requirements (Federal Register 29 CFR, Part 1926). Exposed materials are classified as either Stable Rock, Type A, B or C. Each material classification requires different temporary excavation slope gradients. Maximum allowable slopes for excavations less than 20 feet deep are presented as Table 8.

Table 8: Maximum Allowable Temporary Slopes

Soil or Rock Type	Maximum Allowable Slopes[1] for Excavations (< 20 Feet)[2]	
Stable Rock	Vertical	90º
Type A	3H:4V	53º
Type B	1H:1V	45º
Type C	3H:2V	34º

NOTES:

1. Angles are expressed in degrees from the horizontal and have been rounded off.
2. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.
3. For detailed description of the soil types outlined above visit the US Department of Labor Safety and Health Topics website at: https://www.osha.gov/SLTC/trenchingexcavation/construction.html

The contractor is responsible for determining soil classifications in the field during trenching activities and for selecting appropriate protective systems in accordance with OSHA requirements. Based on the subsurface conditions encountered during our exploration, trench excavations at the site are anticipated to generally comply with **Type B** soil conditions; however, subsurface conditions at the time of construction shall govern layback requirements.

Trench excavations shall be protected from surface water and runoff. Protection measures may include temporary drainage swales, berms, or shallow diversions to direct surface flow away from excavations. If necessary, dewatering of pipe trench excavations may be accomplished using a temporary dewatering system.

9.3.2 UNDERMINING OF ADJACENT INSTALLATIONS

The use of shoring or shielding may be required during excavation, to limit the potential for undermining of existing structures the contractor shall review the following:

- Trench boxes may be used (i.e., unshored trench excavations) where the proposed excavation is laterally offset from existing structure bottom of foundation elevation a distance determined by a 1 horizontal by 1 vertical (1H:1V) projection line (downward and outward) from the exterior edge of the structure foundation (e.g., “zone of influence”).
- At a minimum, shoring is required where trenches are located within or will intercept the zone of influence (1H:1V). Shoring systems will need to be designed to resist the lateral earth pressure forces, applicable hydrostatic forces, as well as contributing structural dead loads, and/or adjacent live loads.
- It should be noted that shoring systems such as slide rail require a “dig and push” method for installation. Care should be taken during installation that the excavation for the panels is done carefully to reduce the potential for gaps between the steel panels and existing soil. Gaps between the steel panels and trench sidewall may result in an increased potential for lateral movement of the soil below the adjacent structure foundations as material is pushed laterally into the steel sheet.
- Alternatively, where shoring is not possible, underpinning the adjacent structure foundations may be performed prior to excavation.
- All trenching shall be performed in general accordance with applicable OSHA regulations. The contractor is responsible for the safety of field personnel and to protect existing structures.
- Monitoring of movement of the adjacent structures should be performed during installation of the shoring system and/or during trenching activities within the zone of influence (1H:1V). Refer to Figure 7 for additional information.

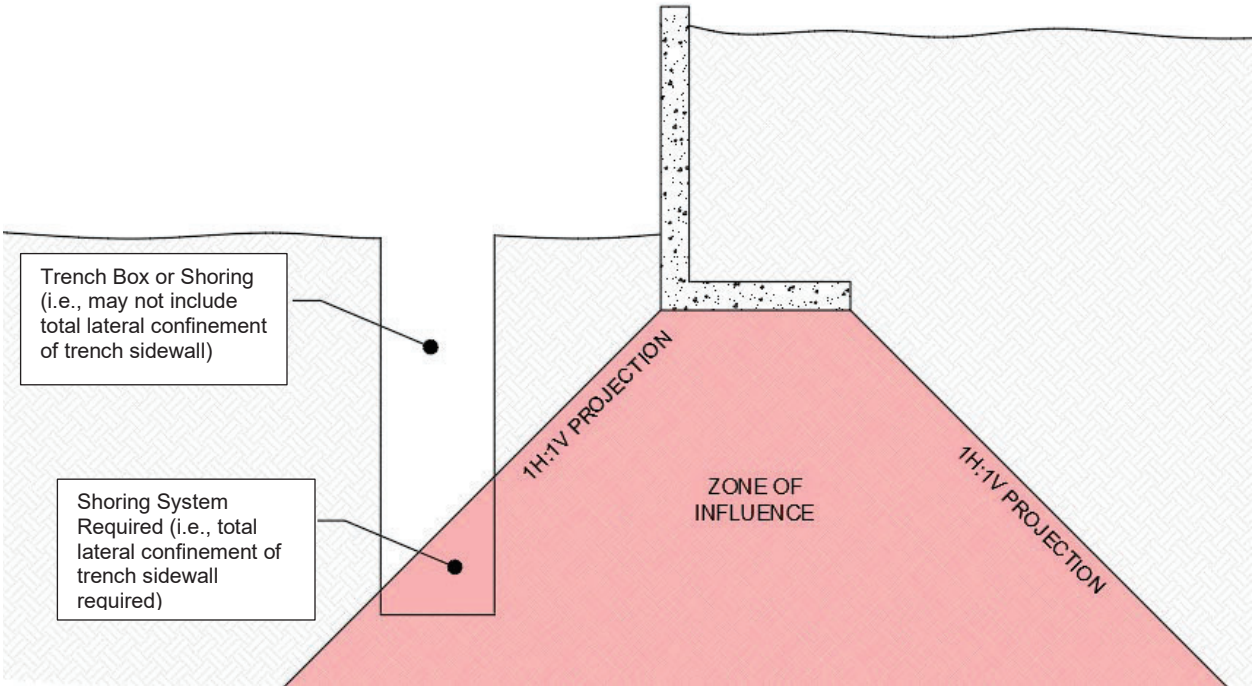


Figure 7: Zone of Influence and Shoring Requirement Schematic

9.4 CONCRETE

9.4.1 CORROSION POTENTIAL

Many external sources can affect the potential for sulfate attack against concrete ranging from soil type, marine/wetland environments, to deicing and industrial conditions. The American Concrete Institute (ACI) Committee 201 and ACI 318-14 have established guidelines for determining the potential for sulfate attack from external sources. Table 9 has been developed to provide the design engineer with guideline recommendations for cement type based on the severity of potential sulfate exposure associated with the tested soils encountered during the current exploration.

Table 9: General Guideline Requirements for Concrete Subject to Sulfate Exposure

Severity of Potential Exposure	Water Soluble Sulfate (SO_4) in soil (%) by mass	Sulfate (SO_4) in water (ppm)	Maximum Water Cementitious Materials Ratio	Cementitious Material Requirements
S0 (negligible)	$SO_4 < 0.10$	$SO_4 < 150$	No Requirement	No Requirement
S1 (Moderate)	$0.10 < SO_4 < 0.20$	$150 < SO_4 < 1,500$	0.50	ASTM C150 Type II Cement
S2 (Severe)	$0.2 < SO_4 < 2.0$	$1,500 < SO_4 < 10,000$	0.45	ASTM C150 Type V Type I Cement with 20% Class N Pozzolan Type I Cement with 20% Class F Fly Ash
S3 (Very Severe)	$SO_4 > 2.0$	$SO_4 > 10,000$	0.40	Refer to ACI 201.2R.16 and ACI 318-14

NOTES:
1. Table reference: ACI 201.2R.16, publication Table 6.1.4.1a and 6.1.4.1b and ACI 318-14, Table 19.3.1.1

Soil chemistry test results are included in Appendix B and on Table 10.

Table 10: Soil Sulfate Content Results

Exploration Designation	Sample ID	Sample Depth (ft-ft)	Sulfate Content (%)	Severity of Potential Exposure	w/cm by mass, maximum	Permitted Cement Type
B-26-01	BULK	0.0-5.0	0.02	S0 (negligible)	No w/cm restriction	No type restriction

NOTES:
1. A corrosion specialist should be consulted to determine if the site soil conditions warrant further investigation or if proposed structures require corrosion protection.

Based on the soil chemistry test results, no cement type restriction is required for sulfate exposure and Type II cement may be used for project design.

9.4.2 CONCRETE SLABS

All concrete slabs and flatwork shall be directly underlain by aggregate base. The minimum thickness of base material shall comply with the following:

Structure Type	Aggregate Base Minimum Thickness (in)
Curb and Gutter	6.0
Exterior Sidewalks and Slabs	4.0
Interior Structure Slabs	6.0

Subgrade soil below the aggregate base and the aggregate base shall be prepared in accordance with the recommendations of this report.

The contractor shall submit a concrete mix design to the owner at least 10 working days prior to construction for approval. Concrete mix proportions and construction techniques, including the addition of excess water and improper curing, can adversely affect the finished quality of the concrete resulting in cracking, curling, and spalling of slabs. We recommend that all placement and curing be performed in accordance with procedures outlined by the American Concrete Institute. Special considerations should be given to concrete placed and cured during hot or cold weather conditions. Proper control joints and reinforcing should be provided to minimize any damage resulting from shrinkage.

9.5 SITE DRAINAGE AND MOISTURE MIGRATION MANAGEMENT

Site Drainage	The project site will be subjected to seasonal runoff. Adequate surface drainage shall be constructed and maintained to convey the water away proposed structures. The permanent finished slope grade away from the structure should be at least 5 percent for a minimum distance of 10 feet away from the building (IBC Section 1804.4). The slope gradient can be reduced to 2 percent for impervious surfaces, such as concrete slabs-on-grade and pavement, constructed adjacent to the building. It is recommended that all runoff is collected within permanent drainage paths away from the structure to convey water off the property.
Stem-Wall Backfill	Stem-walls constructed for this project with retained heights of less than 3 feet will not require a retained backfill drainage system provided the backfill is compacted to at least 90 percent relative compaction and the recommendations for site drainage are adhered too.
Concrete Slab-on-Grade	The transmission of moisture to the base of the slab can occur through two physical processes: water vapor transmission and/or capillary action of the underlying soils. Water vapor can be transmitted through the slab and the transmission rate depends on the difference in the water vapor pressure between the air voids in the slab and the air above the slab. Moisture vapor migrating through the slab can cause the debonding and discoloration of tile, linoleum, or other products placed directly on the concrete slab. For heated facilities and where sensitive floor coverings or equipment are planned, or moisture sensitive materials will be stored, as noted in Section 1907 (Minimum Slab Provisions) of the 2024 IBC, a polyethylene vapor retarder is recommended for slab-on-grade construction[4]. The vapor retarder system shall conform to ASTM E1745. A Class A (ASTME-1745) vapor retarder is recommended for project design (such as a 15-mil Stego Wrap or approved alternate). The vapor retarder shall be placed between the base course and subgrade (ASTM E1643[5]) . Where specialty curing compounds or slab systems are proposed, installation should follow the manufacturer's recommendations.

[4] When a vapor retarder is required, a capillary break shall be installed.
[5] Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

10.0 TESTING AND DOCUMENTATION

The recommendations presented in this report are based on the assumption that the owner or project manager will provide sufficient construction review and field testing during all phases of work. These construction observation and testing services should include, but not be limited to, the following:

- Observation, documentation, and field density testing during site preparation and grading
- Special inspection and structural observation in accordance with the applicable edition of the International Building Code for concrete and reinforcing steel
- Laboratory testing to confirm materials qualification and compliance with project specifications
- Field density testing of utility bedding sand and trench backfill

CME maintains a staff of certified inspectors, technicians, and materials testing personnel capable of providing these services.

Prior to construction, the owner or project manager should schedule a preconstruction meeting. Attendees should include, at a minimum, the owner or project manager, design engineer, general contractor, earthwork and materials subcontractors, and CME representatives. This meeting provides an opportunity to review the project plans, specifications, and recommendations contained in this report, and to discuss material requirements, testing procedures, and construction coordination items.

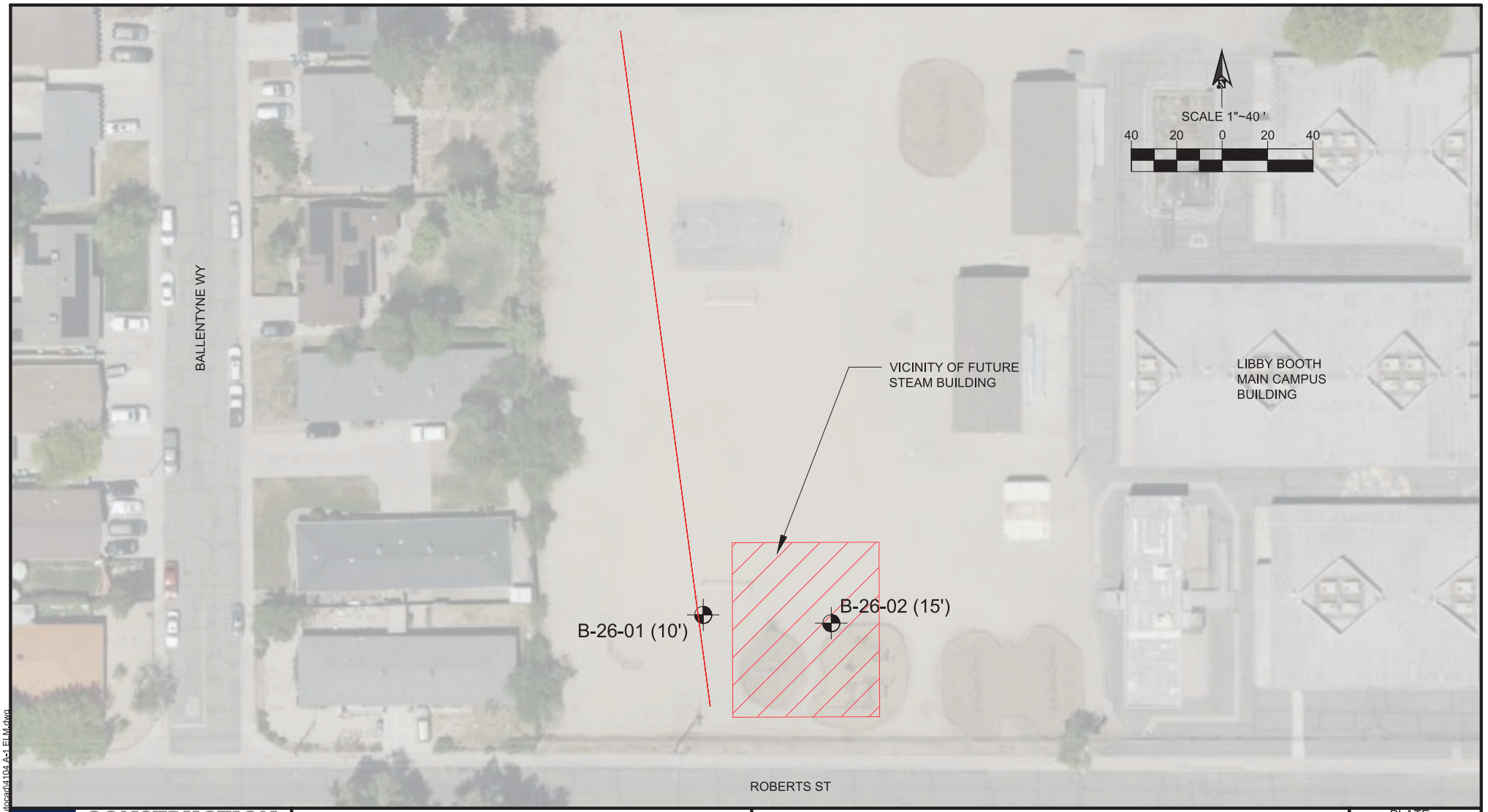
Additional client-requested pre-construction and construction-phase services that CME can provide include:

- Construction Management (CM) support to assist owners with schedule oversight, contractor coordination, and quality assurance throughout construction
- Independent Cost Estimating (ICE) services to support project budgeting, change-order review, and proactive cost control
- Engineer's Opinion of Probable Construction Cost (EOPCC) services prepared at key design milestones to support budgeting, funding decisions, and bid readiness

11.0 LIMITATIONS

Exploration Location and Geologic Variations	• This report has been prepared in accordance with generally accepted local geotechnical practices. The conclusions and recommendations of this report are provided for the design and construction of the proposed project as described in this report. The analyses and recommendations contained herein are based upon field exploration locations included on Plate A-1. • Exploration locations included as part of this report should be considered accurate only to the degree implied by the methods used. This report does not reflect soil, rock, or groundwater variations that may become evident during the construction period, at which time re-evaluation of the recommendations may be necessary.
General Intent and Information Distribution	• The intent of this report is to provide geotechnical information related to construction and design of the project. The owner/project manager is responsible for distribution of this report to all designers and contractors whose work is affected by geotechnical recommendations provided. In the event of changes in the design, location, or ownership of the project prior to construction, our recommendations should be reviewed by our geotechnical representative. • If our engineer is not accorded the privilege of making this recommended review, the CME can assume no responsibility for misinterpretation or misapplication of his recommendations or their validity in the event changes have been made in the original design concept without our prior review.
Warranties	• CME makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement and included in this report. Any use, reliance on, or decisions which a third party makes based upon the information contained in this report, are the sole responsibility of such third parties. CME accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.
Clay Soil	• Clay soil may be present in discontinuous areas below the proposed improvements. Clay soil may potentially shrink or swell (volume changes) in response to changes in the moisture content of the soil. Moisture changes in this soil can occur as a result of seasonal variations in precipitation, poor site drainage, landscape irrigation, leaking underground pipes, capillary action, or from other sources. Volume changes in clay soil can cause differential movements in structural elements constructed in the sphere of influence or bearing on the clay soil. The project geotechnical engineer shall be notified where questionable soil is encountered.
Standard Owner Maintenance/ Monitoring	• All structures are susceptible to deterioration caused by environmental and human-made factors. Consequently, regular monitoring and maintenance are essential to prevent damage and deterioration. The owner bears the sole responsibility for carrying out these monitoring and maintenance activities. CME, Inc. assumes no responsibility for such issues or any resulting damages.
Environmental Hazards Evaluation	• Any evaluation of the site for the presence of surface or subsurface hazardous substances is beyond the scope of this study. When suspected hazardous substances are encountered during routine geotechnical investigations, they are noted in the exploration logs and reported to the client.
Fault Hazards	• Please be aware that our exploration and analysis are bound by the constraints inherent in the scope of our investigation and the available data. Unmapped faulting, which is common in Nevada, may remain unidentified or uncharted due to various factors, including the scale of published mapping, sediment coverage, depth within the earth, or a lack of prior study. Detection often relies on advanced techniques such as seismology, LiDAR, orthophoto review, and onsite exploration outside the parameters of our study. Should you desire a site-specific fault study, we recommend consulting our office or a qualified fault investigation specialist for further analysis.

APPENDIX A



CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, NV 89511

WASHOE COUNTY SCHOOL DISTRICT
LIBBY BOOTH ELEMENTARY SCHOOL - STEAM BUILDING
EXPLORATION LOCATION MAP
RENO, WASHOE COUNTY, NEVADA
PROJECT NO.: 4104 DATE:02/26/2027

LEGEND
APPROXIMATE BORING LOCATION
APPROXIMATE REMI LINE LOCATION

PLATE
A-1

V:\Projects\Active\4104\autocad\4104 A-1 FILM.dwg

LOG OF BORING B-26-01

PROJECT NO: 4104	**DRILLING CONTRACTOR:** TABER	**BEGIN DATE:** 1/19/2026
PROJECT: LIBBY BOOTH STEAM BUILDING	**DRILLING METHOD:** HOLLOW-STEM AUGER	**COMPLETION DATE:** 1/19/2026
LOCATION: 39.52045, -119.79557	**DRILL RIG:** Diedrich 120 Truck	**SURFACE ELEVATION:** 4463 (ft) (Google Earth)
	SAMPLER TYPE & SIZE: SPT/BULK	**BACKFILL METHOD:** CUTTINGS/PEA GRAVEL
CLIENT: WCSD	**HAMMER TYPE:** Auto: 140lb; 30in	**WATER DEPTH:** NOT ENCOUNTERED
LOGGED BY: WWR	**HAMMER EFFICIENCY:** 95% (Report dated 7/15/2025)	**READING TAKEN:**

DRILL METHOD / CASING DEPTH	ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	qu, POCKET PEN. (TSF)	TORVANE, Su (KSF)	GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	RQD (%)	LABORATORY: LIQUID LIMIT	LABORATORY: PLASTICITY INDEX	LABORATORY: MOISTURE (%)	LABORATORY: D. DENSITY (PCF)	LABORATORY: % PASSING 200 SIEVE	REMARKS
		0								**Poorly graded SAND with SILT (SP-SM)**; brown/tan; moist; 0.0 - 2.0 INCHES OF PLAYGROUND SAND. 0.2								
		1								**SILTY SAND with GRAVEL and COBBLES (SM)**; brown/gray; dry; about 10 to 20% moderately weathered, moderately soft COBBLES; about 35% coarse to fine, angular to subangular GRAVEL; about 40% coarse to fine, subangular to subrounded SAND; about 15% nonplastic fines. 1.5								
	4461.0	2								**CLAYEY GRAVEL with SAND (GC)**; brown; dry; about 45% coarse to fine, angular to subangular GRAVEL, up to 1 in. nominal diameter; about 35% coarse to fine, subangular to subrounded SAND; about 20% low plasticity, low toughness fines.								
		3	BULK	A	14 17 16	33					56		24	10	6.2		18.1	
	4459.0	4																
		5								5.0								
										SILTY SAND (SM); brown; dry; about 5% fine, subangular GRAVEL; about 70% coarse to fine, subangular to subrounded SAND; about 25% nonplastic fines.								
	4457.0	6		B	9 12 15	27					83		NV	NP	11.8		24.9	
		7																
										Brown/dark brown.								
	4455.0	8		C	9 9 13	22					89							
		9																
										Light brown/white; about 80% SAND; about 15% fines.								
	4453.0	10		D	19 40 34	74					92				3.3		14.1	
		11								11.5								
										Bottom of borehole at 11.5 ft bgs								
										TERMINATED @ TARGET DEPTH								

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

Construction Materials Engineers, Inc.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511
(775) 851-8205

PROJECT NUMBER: 4104
PROJECT: LIBBY BOOTH STEAM BUILDING
EXPLORATION: B-26-01
ENTRY BY: WWR **PLATE:** A-2
CHECKED BY: **SHEET** 1 of 1

LOG OF BORING B-26-02

PROJECT NO: 4104	**DRILLING CONTRACTOR:** TABER	**BEGIN DATE:** 1/19/2026
PROJECT: LIBBY BOOTH STEAM BUILDING	**DRILLING METHOD:** HOLLOW-STEM AUGER	**COMPLETION DATE:** 1/19/2026
LOCATION: 39.52044, -119.79537	**DRILL RIG:** Diedrich 120 Truck	**SURFACE ELEVATION:** 4461 (ft) (Google Earth)
	SAMPLER TYPE & SIZE: SPT/MCAL/BULK	**BACKFILL METHOD:** CUTTINGS/PEA GRAVEL
CLIENT: WCSD	**HAMMER TYPE:** Auto: 140lb; 30in	**WATER DEPTH:** NOT ENCOUNTERED
LOGGED BY: WWR	**HAMMER EFFICIENCY:** 95% (Report dated 7/15/2025)	**READING TAKEN:**

DRILL METHOD / CASING DEPTH	ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	qu, POCKET PEN. (TSF)	TORVANE, Su (KSF)	GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	RQD (%)	LABORATORY: LIQUID LIMIT	LABORATORY: PLASTICITY INDEX	LABORATORY: MOISTURE (%)	LABORATORY: D. DENSITY (PCF)	LABORATORY: % PASSING 200 SIEVE	REMARKS
										Poorly graded SAND with SILT (SP-SM); brown/tan; moist; 0.0 - 2.0 INCHES OF PLAYGROUND SAND. 0.2									@ 0.5' heavy grinding heard and difficulties drilling Due to large size and quanitity of cobbles, hole was shifted 3FT West
	4459.0	2								**SILTY SAND with GRAVEL and COBBLES (SM)**; brown/gray; dry; about 10% moderately weathered, moderately soft COBBLES; about 34% coarse to fine, angular to subangular GRAVEL; about 45% coarse to fine, subangular to subrounded SAND; about 21% nonplastic fines.								
		3	BULK	A	18 16 17	33					44		21	2	7.8		21.4	
	4457.0	4								4.5								
		5								**SILTY SAND (SM)**; brown; dry to moist; about 10% fine, angular to subangular GRAVEL; about 60% coarse to fine, subangular to subrounded SAND; about 30% low plasticity, low toughness fines.								@ 4.5' drilling became easier
	4455.0	6		B	7 9 15	24					72		31	6				Soil testing performed on combined sample B and C
		7																
	4453.0	8		C	13 11 16	27					78							
		9								10.0								
	4451.0	10		D	50/5	REF				**Poorly graded GRAVEL with SAND (GP)**; brown; dry; about 60% fine, angular to subangular GRAVEL; about 33% coarse to fine, subangular to subrounded SAND; about 7% nonplastic fines.	100							
		11																@ 11' drilling became more difficult
	4449.0	12																
		13		E	17 18 41	59					44				11.0		7.2	
	4447.0	14																
		15		F	34 50/2	50/2				15.7	50							
	4445.0	16								Bottom of borehole at 15.7 ft bgs TERMINATED @ TARGET DEPTH								
		17																

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

Construction Materials Engineers, Inc.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511
(775) 851-8205

PROJECT NUMBER: 4104
PROJECT: LIBBY BOOTH STEAM BUILDING
EXPLORATION: B-26-02
ENTRY BY: WWR **PLATE:** A-2
CHECKED BY: **SHEET** 1 of 1

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

SOIL CLASSIFICATION CHART

PLATE A-3

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL CLASSIFICATION NAMES
Course grained soils (More than 50% of the material is larger than No. 200 sieve size)	Gravel and gravelly soils	Clean gravels		GW	Well-graded gravels, gravel-sand mixtures, few or no fines
				GP	Poorly-graded gravels, gravel-sand mixtures, few or no fines
		Gravels with fines		GM	Silty gravels, gravel-sand-silt mixtures
				GC	Clayey gravels, gravel-sand-clay mixtures
	Sand and sandy soils	Clean sands		SW	Well-graded sands, gravelly sands, few or no fines
				SP	Poorly-graded sands, gravelly sands, few or no fines
		Sands with fines		SM	Silty sands, sand-silt mixtures
				SC	Clayey sands, sand-clay mixtures
Fine grained soils (More than 50% of the material is smaller than No. 200 sieve size)	Silts and clays	Liquid Limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
				OL	Organic silts and organic silt-clays of low plasticity
		Liquid Limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
				CH	Inorganic clays of medium to high plasticity
				OH	Organic clays of medium to high plasticity
				PT	Peat or other highly organic soils

NOTES:
1. Dual classifications may occur (e.g. SP-SM, CL-ML, GP-GC)

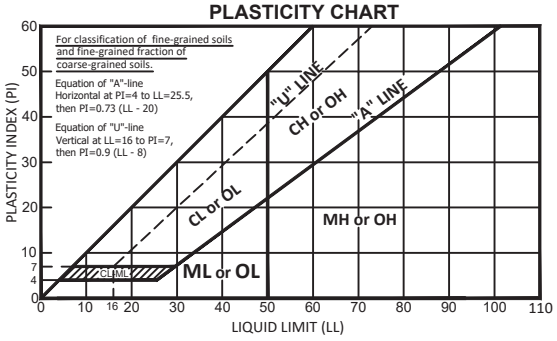
SOIL SAMPLE TYPES

- Bulk Sample
- Grab Sample
- Standard Penetration Test (2.0" OD, 1.42" ID)
- California Modified Sampler (3.0" OD, 2.42" ID)
- Thin walled Shelby Tube (3.0" OD)
- Rock Core

GROUNDWATER SYMBOLS

- Water level during drilling
- Water level after drilling

PLASTICITY CHART



PARTICLE ANGULARITY

Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	Particles are similar to angular, but have rounded edges
Subrounded	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

PARTICLE SHAPE

Flat	Particles with width/thickness >3
Elongated	Particles with length/width >3
Flat and Elongated	Particles meet criteria for both flat and elongated

MOISTURE

Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

CEMENTATION

Weak	Crumbles or breaks with handling or light finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

APPARENT DENSITY OF COHESIONLESS SOIL

	SPT (1.4" ID) N_{60}
Very Loose	< 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Based on 60% energy ratio (ER_i). $N_{60} = N_{measured} * (ER_i/60)$

California Modified Sampler can be corrected to SPT by multiplying by 0.62

PARTICLE SIZE, Ps

Boulders		Ps > 12"
Cobbles		3" < Ps ≤ 12"
Gravel	coarse	$\frac{3}{4}$" < Ps ≤ 3"
	fine	$\frac{1}{5}$" < Ps ≤ $\frac{3}{4}$"
Sand	coarse	$\frac{1}{16}$" < Ps ≤ $\frac{1}{5}$"
	medium	$\frac{1}{64}$" < Ps ≤ $\frac{1}{16}$"
	fine	$\frac{1}{300}$" < Ps ≤ $\frac{1}{64}$"
Fines		Ps ≤ $\frac{1}{300}$"

PERCENT OF SOIL, Pp

Trace	Pp < 5%
Few	5 ≤ Pp ≤ 15%
Little	15 ≤ Pp ≤ 30%
Some	30 ≤ Pp ≤ 50%
Mostly	50 ≤ Pp ≤ 100%

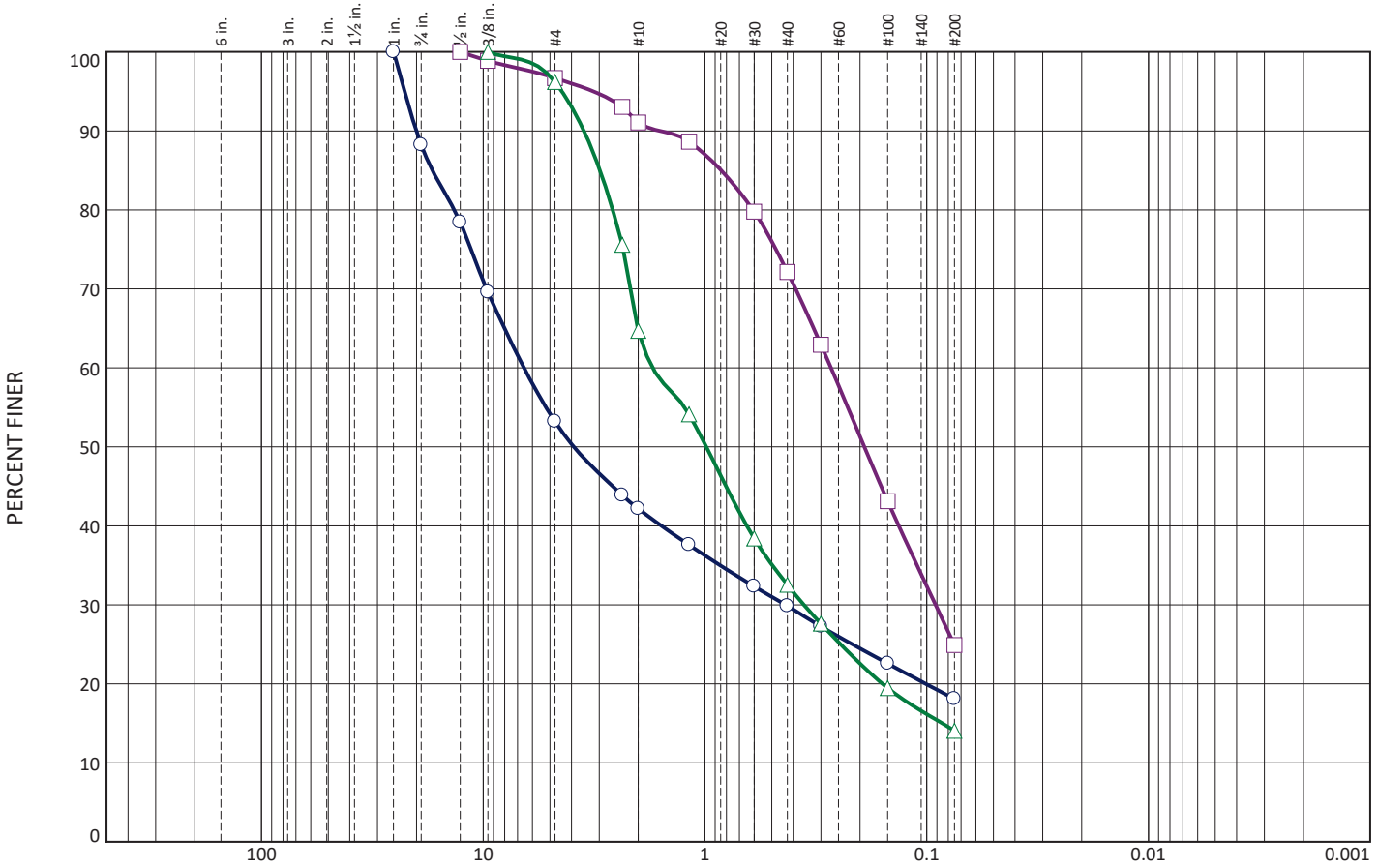
CONSISTENCY OF COHESIVE SOIL

	SPT (1.4"ID) N_{60}	Unconfined Compressive Strength (psf)	Pocket Penetrometer (tsf)
Very Soft	0 - 1	< 500	< 0.25
Soft	2 - 4	500 - 1,000	0.25 - 0.5
Medium Stiff	5 - 8	1,000 - 2,000	0.5 - 1.0
Stiff	9 - 15	2,000 - 4,000	1.0 - 2.0
Very Stiff	16 - 30	4,000 - 8,000	2.0 - 4.0
Hard	31 - 60	8,000 - 16,000	> 4.0
Very Hard	> 60	> 16,000	

APPENDIX B

Particle Size Distribution Report

ASTM C117 & C136



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	11.8	35.0	11.0	12.3	11.8	18.1	
□	0.0	0.0	3.3	5.6	19.0	47.2	24.9	
△	0.0	0.0	3.8	31.5	32.2	18.4	14.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	24	14	16.9574	6.5482	3.9025	0.4331				
□	NV	NP	0.8448	0.2702	0.1912	0.0912				
△			2.9754	1.7233	0.9866	0.3580	0.0851			

	Material Description	Test Date	USCS	NM
○	clayey gravel with sand	2/2/2026	GC	6.2
□	silty sand	2/2/2026	SM	11.8
△		2/2/2026		3.3

Project No. 4104 **Client:** WASHOE COUNTY SCHOOL DISTRICT

Project: LIBBY BOOTH ELEMENTARY SCHOOL MODERNIZATION-STEAM BUILDING

○ **Source of Sample:** B-26-01 **Depth:** 0-5' **Sample Number:** BULK

□ **Source of Sample:** B-26-01 **Depth:** 5-6.5' **Sample Number:** 1B

△ **Source of Sample:** B-26-01 **Depth:** 10-11.5' **Sample Number:** 1D

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

Remarks:

○ RECEIVED ON 1/285/2026

□ RECEIVED ON 1/28/2026

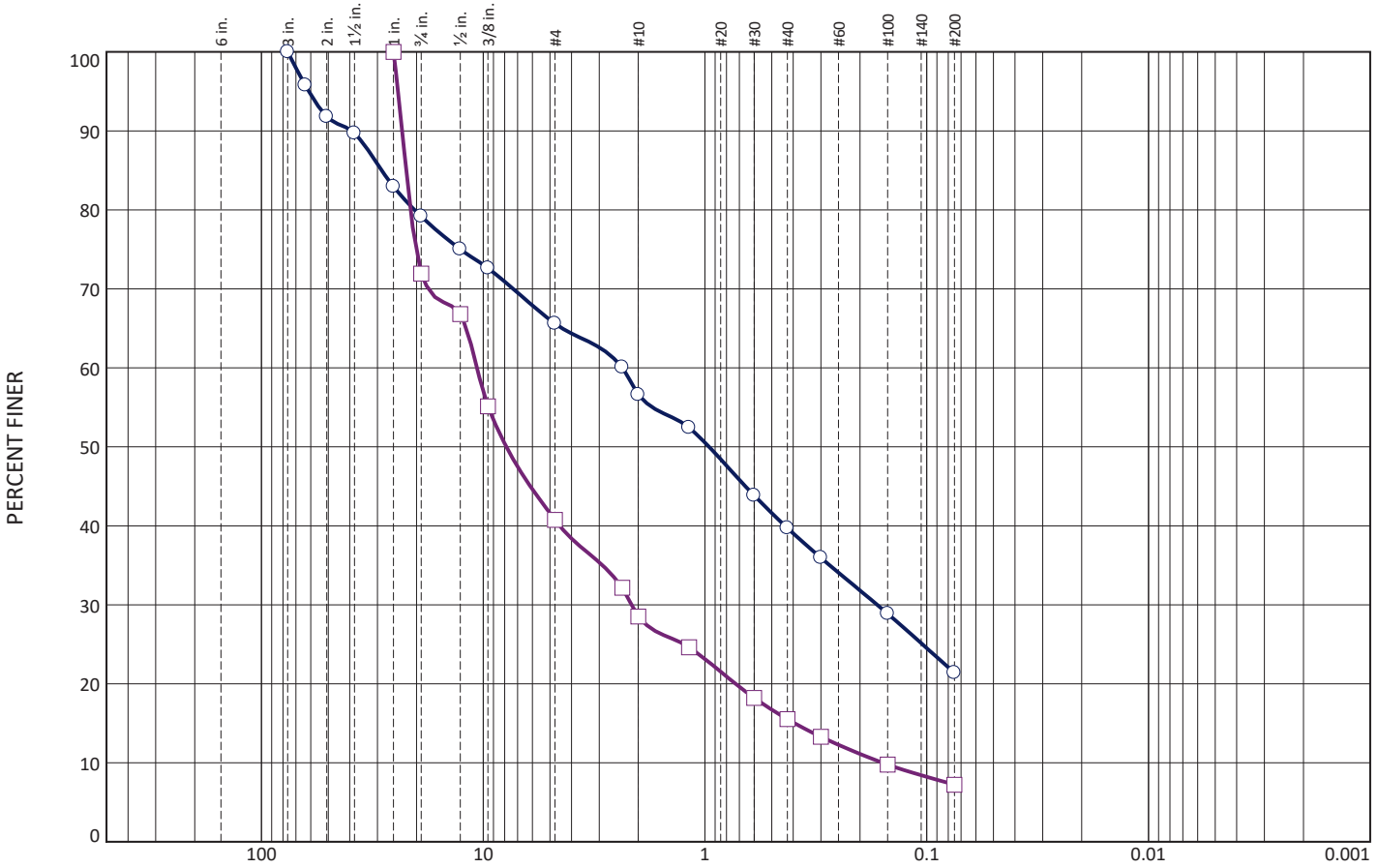
△ RECEIVED ON 1/28/2026

PLATE B-1a

Tested By: M. DAY **Checked By:** S. SCHWEITZER

Particle Size Distribution Report

ASTM C117 & C136



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	20.8	13.6	9.0	16.9	18.3	21.4	
□	0.0	28.1	31.1	12.3	13.0	8.3	7.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	21	19	28.7025	2.3480	0.9581	0.1672				
□			22.2506	10.6755	7.8628	2.1475	0.3940	0.1578	2.74	67.63

	Material Description	Test Date	USCS	NM
○	silty sand with gravel	2/2/2026	SM	7.8
□		2/2/2026		11.0

Project No. 4104 **Client:** WASHOE COUNTY SCHOOL DISTRICT

Project: LIBBY BOOTH ELEMENTARY SCHOOL MODERNIZATION-STEAM BUILDING

○ **Source of Sample:** B-26-02 **Depth:** 0-5' **Sample Number:** BULK

□ **Source of Sample:** B-26-02 **Depth:** 12.5-14' **Sample Number:** 2E

Remarks:

○ RECEIVED ON 1/28/2026

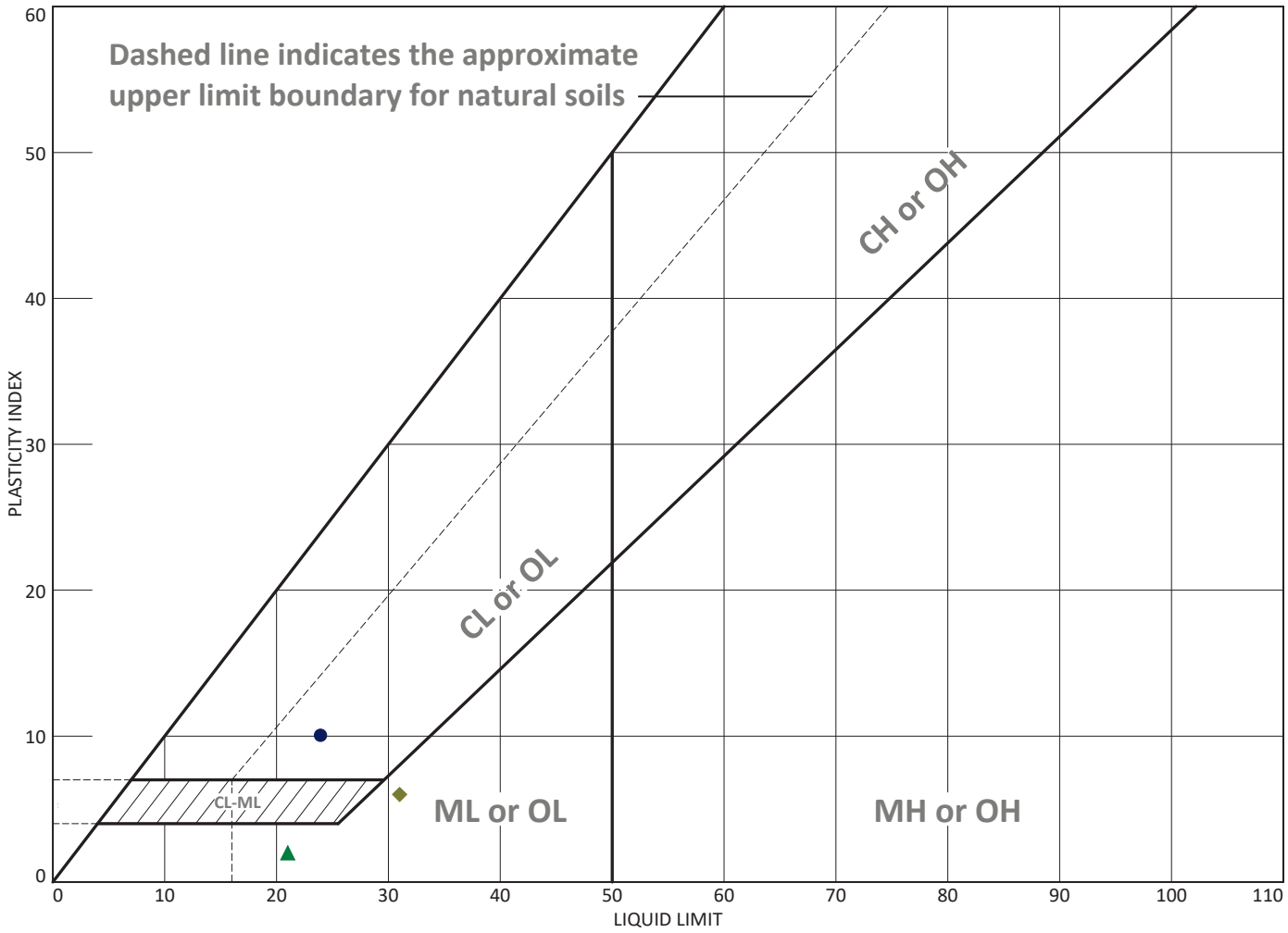
□ RECEIVED ON 1/28/2026

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

PLATE B-1b

Tested By: M. DAY **Checked By:** S. SCHWEITZER

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	clayey gravel with sand	24	14	10	29.9	18.1	GC
■	silty sand	NV	NP	NP	72.1	24.9	SM
▲	silty sand with gravel	21	19	2	39.7	21.4	SM
◆		31	25	6			
▼					15.5	7.2	

Project No. 4104 **Client:** WASHOE COUNTY SCHOOL DISTRICT

Project: LIBBY BOOTH ELEMENTARY SCHOOL MODERNIZATION-STEAM BUILDING

●	**Source of Sample:** B-26-01	**Depth:** 0-5'	**Sample Number:** BULK
■	**Source of Sample:** B-26-01	**Depth:** 5-6.5'	**Sample Number:** 1B
▲	**Source of Sample:** B-26-02	**Depth:** 0-5'	**Sample Number:** BULK
◆	**Source of Sample:** B-26-02	**Depth:**	**Sample Number:** 2B & 2C COMBINED
▼	**Source of Sample:** B-26-02	**Depth:** 12.5-14'	**Sample Number:** 2E

Remarks:

●RECEIVED ON 1/28/2026
■RECEIVED ON 1/28/2026
▲RECEIVED ON 1/28/2026
◆RECEIVED ON 1/28/2026

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

PLATE B-2

Tested By: R. FREEMAN **Checked By:** S. SCHWEITZER

SGS North America, Inc.
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478
www.SGS.com

Analytical Report

Workorder#: **26011025**
Date Reported: **2/22/2026**

Client: CME-Construction Materials Engineers, Inc
Project Name: 4104/ Libby Booth ES/ B-26-01 BULK 0'-5'
PO #: 4104

Sampled By: Client

Laboratory Accreditation Number: NV930/CA3029

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
26011025-01	B-26-01 BULK 0'-5'	01/19/2026 0:00	1/29/2026

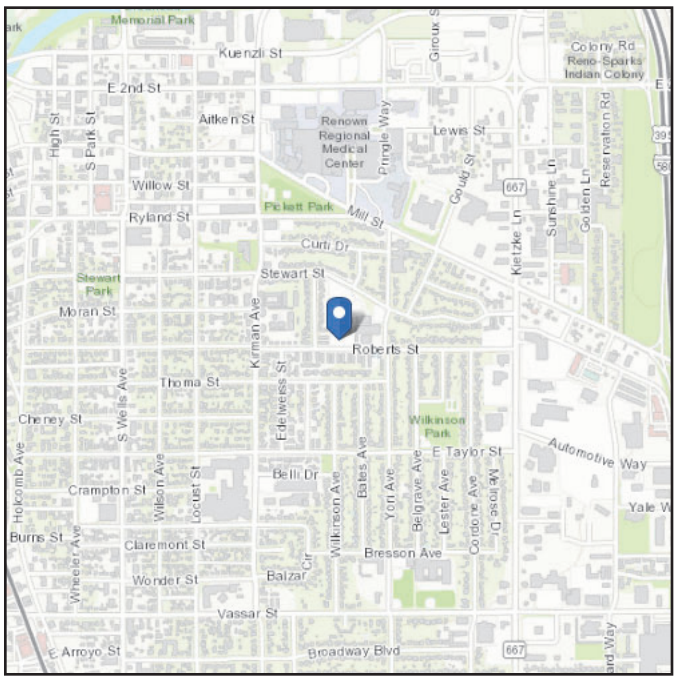
Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Sulfate #	ASTM C1580	0.020	%	0.02	LJ	02/20/2026 9:30	

APPENDIX C

ASCE Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-22	**Latitude:**	39.520437
Risk Category:	III	**Longitude:**	-119.795482
Soil Class:	C - Very Dense Soil and Soft Rock	**Elevation:**	4462.300040395303 ft (NAVD 88)





Seismic

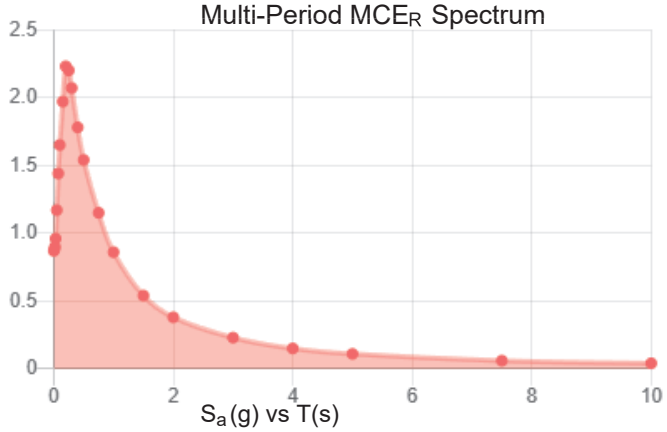
Site Soil Class: C - Very Dense Soil and Soft Rock

Results:

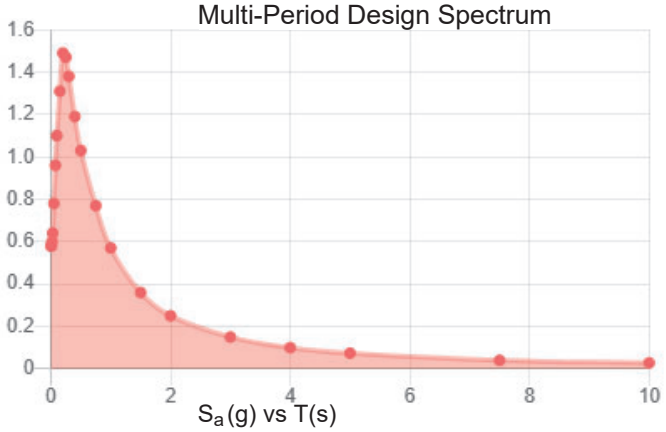
PGA_M :	0.73	T_L :	6
S_{MS} :	2.01	S_S :	1.96
S_{M1} :	0.86	S_1 :	0.6
S_{DS} :	1.34	V_{S30} :	530
S_{D1} :	0.57		

Seismic Design Category: D

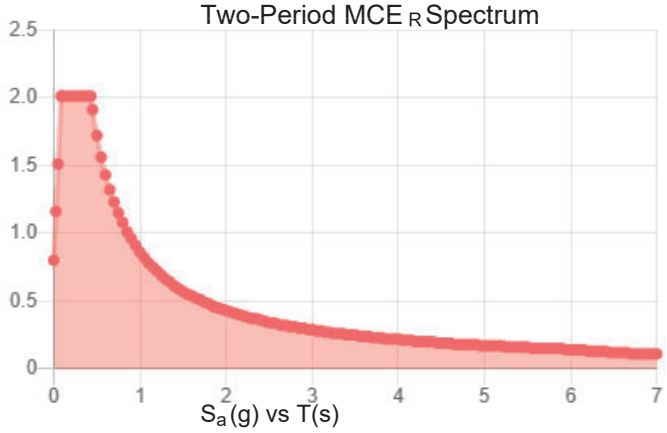
Multi-Period MCE_R Spectrum



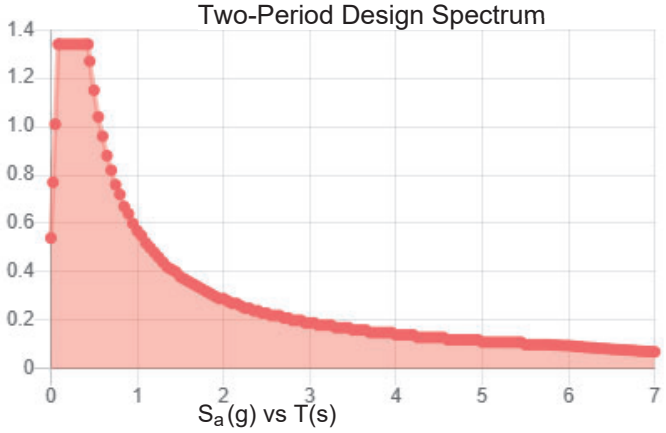
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: Tue Feb 24 2026

Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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APPENDIX D

Liquefaction Screening Assessment Based on Shear-Wave Velocity

Depth		V_s		Static Stresses at Time of Exploration				V_{s1}		V_{S1}*	CSR		CRR			Liquefaction Probability
Depth (ft)	Depth (m)	V_s (fps)	V_s (m/s)	σ (psf)	u (psf)	σ' (psf)	σ' (kPa)	C_v	V_{s1} (m/s)	V_{s1}* (m/s)	r_d	CSR	MSF	K_c	CRR	
0	0.0	1180	360	0	0	0	0	1.40	503	215	1.00	0.475	1.315	1.00	NP	NP
1	0.3	1180	360	125	0	125	6	1.40	503	215	1.00	0.474	1.315	1.00	NP	NP
2	0.6	1180	360	250	0	250	12	1.40	503	215	0.99	0.469	1.315	1.00	NP	NP
3	0.9	1180	360	375	0	375	18	1.40	503	215	0.99	0.469	1.315	1.00	NP	NP
4	1.2	1180	360	500	0	500	24	1.40	503	215	0.99	0.469	1.315	1.00	NP	NP
5	1.5	1180	360	625	0	625	30	1.35	486	215	0.98	0.463	1.315	1.00	NP	NP
6	1.8	1180	360	750	0	750	36	1.29	465	215	0.98	0.463	1.315	1.00	NP	NP
7	2.1	1180	360	875	0	875	42	1.24	447	215	0.98	0.463	1.315	1.00	NP	NP
8	2.4	1180	360	1000	0	1000	48	1.20	432	215	0.98	0.463	1.315	1.00	NP	NP
9	2.7	1180	360	1125	0	1125	54	1.17	420	215	0.96	0.457	1.315	1.00	NP	NP
10	3.0	1180	360	1250	0	1250	60	1.14	409	215	0.96	0.457	1.315	1.00	NP	NP
11	3.4	1180	360	1375	0	1375	66	1.11	399	215	0.96	0.457	1.315	1.00	NP	NP
12	3.7	1180	360	1500	0	1500	72	1.09	391	215	0.95	0.452	1.315	1.00	NP	NP
13	4.0	1180	360	1625	0	1625	78	1.06	383	215	0.95	0.452	1.315	1.00	NP	NP
14	4.3	1180	360	1750	0	1750	84	1.05	376	215	0.95	0.452	1.315	1.00	NP	NP
15	4.6	1180	360	1875	0	1875	90	1.03	369	215	0.94	0.446	1.315	1.00	NP	NP
16	4.9	1180	360	2000	0	2000	96	1.01	364	215	0.94	0.446	1.315	1.00	NP	NP
17	5.2	1180	360	2125	0	2125	102	1.00	358	215	0.94	0.446	1.315	1.00	NP	NP
18	5.5	1180	360	2250	0	2250	108	0.98	353	215	0.94	0.446	1.315	1.00	NP	NP
19	5.8	1525	465	2375	0	2375	114	0.97	450	215	0.92	0.437	1.315	1.00	NP	NP
20	6.1	1525	465	2500	0	2500	120	0.96	444	215	0.92	0.437	1.315	1.00	LP	LP
21	6.4	1525	465	2620	62	2558	122	0.95	442	215	0.92	0.448	1.315	1.00	LP	LP
22	6.7	1525	465	2740	125	2615	125	0.95	439	215	0.90	0.449	1.315	1.00	LP	LP
23	7.0	1525	465	2860	187	2673	128	0.94	437	215	0.90	0.459	1.315	1.00	LP	LP
24	7.3	1525	465	2980	250	2730	131	0.94	435	215	0.90	0.468	1.315	1.00	LP	LP
25	7.6	1525	465	3100	312	2788	133	0.93	432	215	0.88	0.467	1.315	1.00	LP	LP
26	7.9	1525	465	3220	374	2846	136	0.93	430	215	0.88	0.475	1.315	1.00	LP	LP
27	8.2	1525	465	3340	437	2903	139	0.92	428	215	0.88	0.483	1.315	1.00	LP	LP
28	8.5	1525	465	3460	499	2961	142	0.92	426	215	0.87	0.480	1.315	1.00	LP	LP
29	8.8	1525	465	3580	562	3018	145	0.91	424	215	0.87	0.488	1.315	1.00	LP	LP
30	9.1	1525	465	3700	624	3076	147	0.91	422	215	0.87	0.495	1.315	1.00	LP	LP
31	9.4	1525	465	3820	686	3134	150	0.90	420	215	0.87	0.501	1.315	1.00	LP	LP
32	9.8	1525	465	3940	749	3191	153	0.90	418	215	0.85	0.497	1.315	1.00	LP	LP
33	10.1	1525	465	4060	811	3249	156	0.90	416	215	0.85	0.503	1.315	1.00	LP	LP
34	10.4	1525	465	4180	874	3306	158	0.89	414	215	0.85	0.509	1.315	1.00	LP	LP
35	10.7	1525	465	4300	936	3364	161	0.89	413	215	0.83	0.502	1.315	1.00	LP	LP
36	11.0	1823	556	4420	998	3422	164	0.88	491	215	0.83	0.507	1.315	1.00	LP	LP
37	11.3	1823	556	4540	1061	3479	167	0.88	489	215	0.83	0.512	1.315	1.00	LP	LP
38	11.6	1823	556	4660	1123	3537	169	0.88	487	215	0.81	0.504	1.315	1.00	LP	LP
39	11.9	1823	556	4780	1186	3594	172	0.87	485	215	0.81	0.509	1.315	1.00	LP	LP
40	12.2	1823	556	4900	1248	3652	175	0.87	483	215	0.81	0.514	1.315	1.00	LP	LP
41	12.5	1823	556	5020	1310	3710	178	0.87	481	215	0.81	0.518	1.315	1.00	LP	LP
42	12.8	1823	556	5140	1373	3767	180	0.86	479	215	0.79	0.509	1.315	1.00	LP	LP
43	13.1	1823	556	5260	1435	3825	183	0.86	478	215	0.79	0.513	1.315	1.00	LP	LP
44	13.4	1823	556	5380	1498	3882	186	0.86	476	215	0.79	0.517	1.315	1.00	LP	LP
45	13.7	1823	556	5500	1560	3940	189	0.85	474	215	0.77	0.507	1.315	1.00	LP	LP
46	14.0	1823	556	5620	1622	3998	191	0.85	472	215	0.77	0.511	1.315	1.00	LP	LP
47	14.3	1823	556	5740	1685	4055	194	0.85	471	215	0.77	0.514	1.315	1.00	LP	LP
48	14.6	1823	556	5860	1747	4113	197	0.84	469	215	0.75	0.504	1.315	1.00	LP	LP
49	14.9	1823	556	5980	1810	4170	200	0.84	467	215	0.75	0.507	1.315	1.00	LP	LP
50	15.2	1823	556	6100	1872	4228	202	0.84	466	215	0.75	0.510	1.315	1.00	LP	LP

Version 1.1 Updated 11/1/2021

NOTES:

1. Liquefaction screening based on *Liquefaction Resistance of Soils from Shear-Wave Velocity* by Andrus and Stokoe published November 2000 in Journal of Geotechnical and Geoenvironmental Engineering.
2. NP = No Probability; LP = Low Probability; MP = Moderate Probability; SP = Significant Probability
3. Due to limited exploration, some of the input parameters are assumed. If there is a Moderate Probability to Significant Probability, further investigation should be performed

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

WASHOE COUNTY SCHOOL DISTRICT
LIBBY BOOTH STEAM BUILDING
LIQUEFACTION SCREENING ASSESSMENT
RENO, WASHOE COUNTY, NEVADA

PLATE
D-1

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (unknown)

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

39.520437

Time Horizon

Return period in years

2475

Longitude

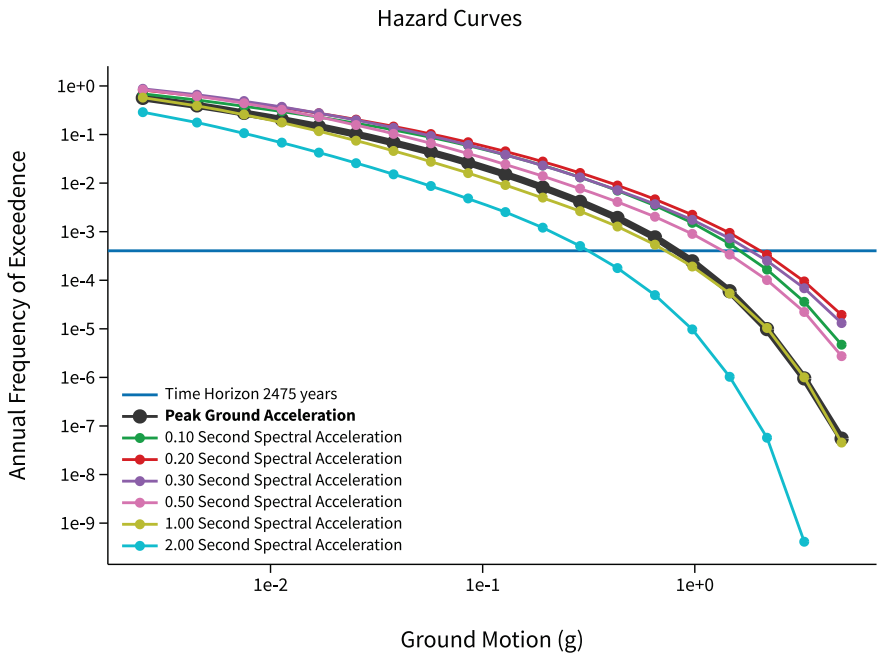
Decimal degrees, negative values for western longitudes

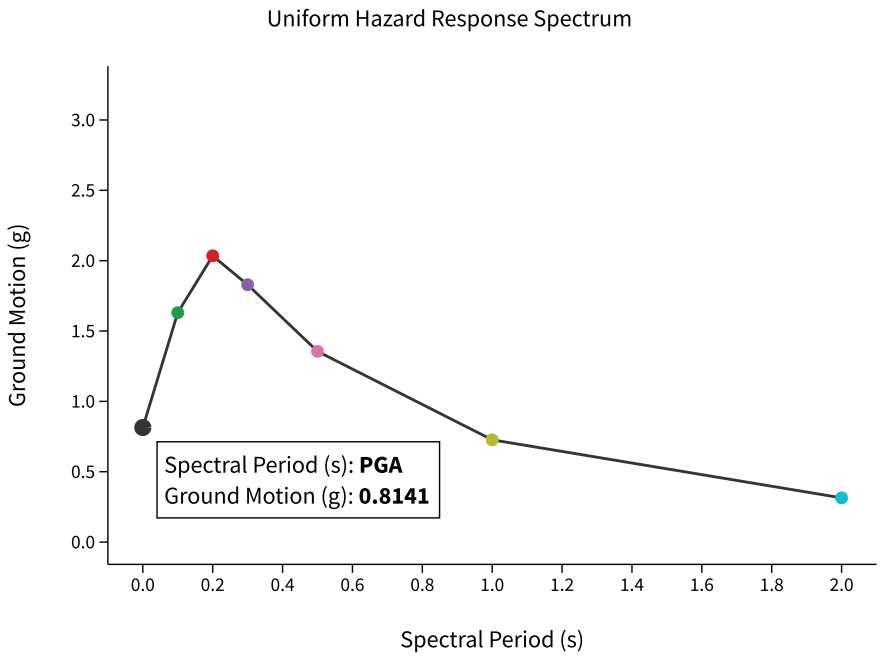
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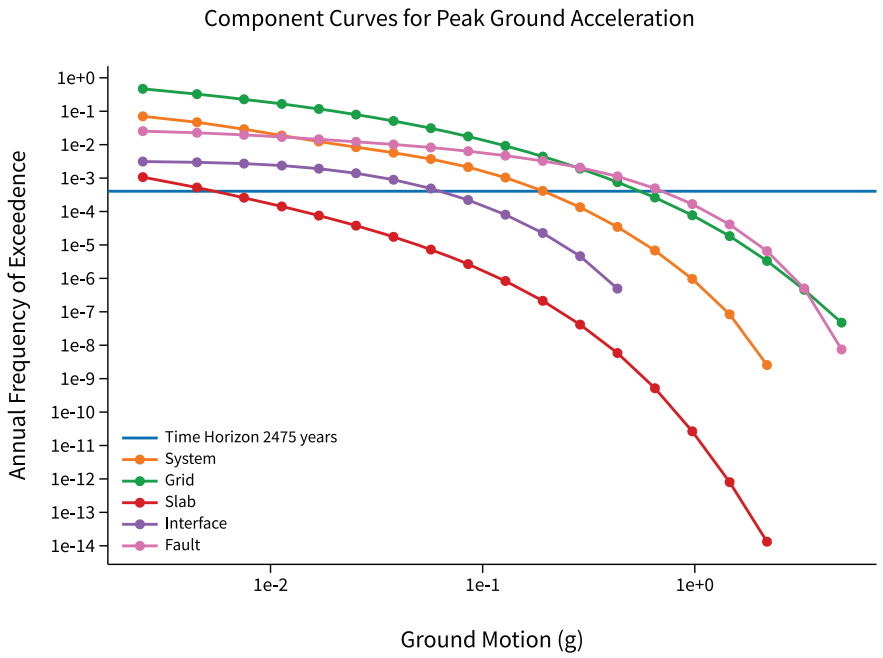
Site Class

537 m/s (Site class C)

Hazard Curve





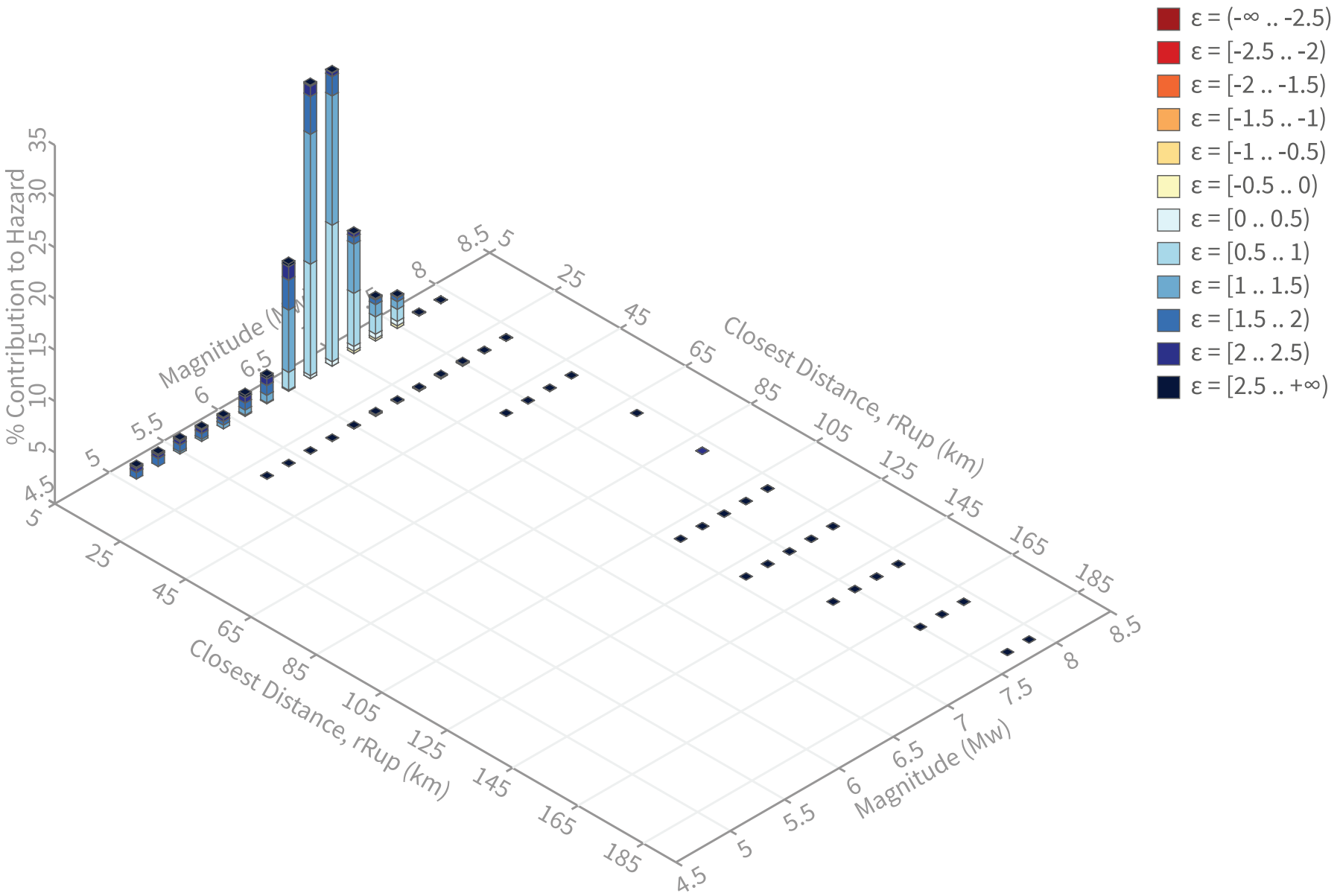


View Raw Data

Deaggregation

Component

Total


% Contribution to Hazard
0
5
10
15
20
25
30
35
Magnitude (Mw)
4.5
5
5.5
6
6.5
7
7.5
8
8.5
Closest Distance, rRup (km)
5
25
45
65
85
105
125
145
165
185
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ε = [-2.5 .. -2)
ε = [-2 .. -1.5)
ε = [-1.5 .. -1)
ε = [-1 .. -0.5)
ε = [-0.5 .. 0)
ε = [0 .. 0.5)
ε = [0.5 .. 1)
ε = [1 .. 1.5)
ε = [1.5 .. 2)
ε = [2 .. 2.5)
ε = [2.5 .. +∞)

Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.81412318 g

Recovered targets

Return period: 2653.211 yrs
Exceedance rate: 0.0003769018 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.05 %

Mean (over all sources)

m: 6.74
r: 6.81 km
ε_0: 1.22 σ

Mode (largest m-r bin)

m: 6.9
r: 6.22 km
ε_0: 1.06 σ
Contribution: 28.64 %

Mode (largest m-r-ε_0 bin)

m: 6.9
r: 5.72 km
ε_0: 0.77 σ
Contribution: 13.32 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
Geologic Model Full Rupture	Fault							33.13
Mount Rose 50		6.29	6.85	1.06	119.849°W	39.469°N	219.25	19.11
Mount Rose 35		5.15	6.85	0.91	119.849°W	39.469°N	219.25	7.87
Mount Rose 65		6.96	6.86	1.22	119.849°W	39.469°N	219.25	4.82
shear4_2014.in	Grid							18.91
PointSourceFixedStrike: -119.800, 39.500		1.67	6.90	0.58	119.800°W	39.500°N	189.68	2.73
PointSourceFixedStrike: -119.700, 39.400		2.71	6.97	0.70	119.700°W	39.400°N	148.50	2.14
PointSourceFixedStrike: -119.800, 39.600		3.51	6.91	0.83	119.800°W	39.600°N	357.49	1.99
PointSourceFixedStrike: -119.900, 39.600		4.57	6.92	0.96	119.900°W	39.600°N	314.67	1.61
PointSourceFixedStrike: -119.900, 39.700		2.76	7.11	0.67	119.900°W	39.700°N	335.88	1.50
PointSourceFixedStrike: -119.800, 39.400		6.16	6.94	1.17	119.800°W	39.400°N	181.66	1.14
PointSourceFixedStrike: -119.700, 39.500		6.51	6.94	1.21	119.700°W	39.500°N	105.48	1.06
Geologic Model Partial Rupture	Fault							13.95
Mount Rose 50		7.24	6.72	1.27	119.849°W	39.469°N	219.25	8.15
Mount Rose 35		6.39	6.72	1.19	119.849°W	39.469°N	219.25	2.99
Mount Rose 65		7.93	6.72	1.39	119.849°W	39.469°N	219.25	2.27
Bird Model Full Rupture	Fault							7.71
Mount Rose 50		6.29	6.85	1.06	119.849°W	39.469°N	219.25	4.22
Mount Rose 35		5.15	6.85	0.91	119.849°W	39.469°N	219.25	1.74
Mount Rose 65		6.96	6.86	1.22	119.849°W	39.469°N	219.25	1.06
Zeng Model Full Rupture	Fault							6.30
Mount Rose 50		6.29	6.85	1.06	119.849°W	39.469°N	219.25	3.66
Mount Rose 35		5.15	6.85	0.91	119.849°W	39.469°N	219.25	1.51
EXTmap_2014_fixSm.ch.in (opt)	Grid							4.68
PointSourceFinite: -119.795, 39.543		5.82	5.67	1.60	119.795°W	39.543°N	0.00	2.63
PointSourceFinite: -119.795, 39.597		9.01	5.91	1.97	119.795°W	39.597°N	0.00	1.04
Bird Model Partial Rupture	Fault							3.25
Mount Rose 50		7.24	6.72	1.27	119.849°W	39.469°N	219.25	1.80

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
Zeng Model Partial Rupture	Fault							2.66
Mount Rose 50		7.24	6.72	1.27	119.849°W	39.469°N	219.25	1.56
EXTmap_2014_fixSm.gr.in (opt)	Grid							2.33
PointSourceFinite: -119.795, 39.543		5.82	5.67	1.60	119.795°W	39.543°N	0.00	1.31
EXTmap_2014_fixSm_M8.in (opt)	Grid							1.45
EXTmap_2014_adSm.ch.in (opt)	Grid							1.44
Geologic Model Small Mag	Fault							1.25

100% CD
STRUCTURAL CALCULATIONS

FOR

Washoe County School District

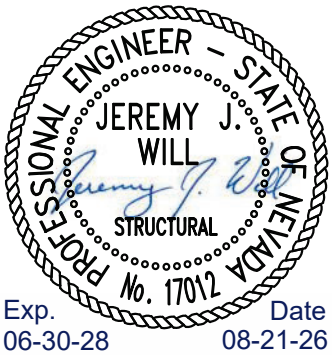
Libby Booth Elementary School
STEAM Building

1450 Stewart Street
Reno, NV 89502

For:

H+K Architects
50 Washington Street, Suite 200
Reno, NV 89503

By:



Exp. 06-30-28

Date 08-21-26

Will Engineering LLC
748 S. Meadows Parkway, Suite A-9
PMB #21
Reno, NV 89521
Phone: (775)560-6554

Design Criteria Summary

Code: **2024 IBC**

Structural Risk Category: **III** (IBC Table 1604.5)

Gravity Loads and Masses:

Roof:

Roof Live Load (Lr): **20 psf** (IBC Table 1607.1)

Snow (S): Per ASCE 7-22 Chapter 7.

$p_f = 0.7C_eC_tp_g$:

At Heated Roof: **36.0 psf**

At Unheated Roof: **36.3 psf**

C_e = *0.9* Per ASCE 7-22 Table 7.3-1.

C_t : Per ASCE 7-22 Table 7.3-2 and 7.3-3.

At Heated Roof: *1.19*

At Unheated Roof: *1.20*

p_g = *48* psf

p_m (at roof slope < 15^0) = **35** psf, Per ASCE 7-22 Sec 7.3.3.

$p_{m,max}$ = *35* Per ASCE 7-22 Table 7.3-4.

$p_s = C_sp_f$:

At Heated Roof: **36.0 psf**

At Unheated Roof: **36.3 psf**

C_s = *1.0*

See attached for unbalanced and drift snow loads

Typical New Roof
Dead (D)

	DL		
Roofing:	2.0	psf	
Future Re-Roof:	2.0	psf	
Insulation:	1.5	psf	
Metal Deck:	3.1	psf	
Roof Framing*:	5.0	psf	
Sprinklers:	0.5	psf	
Ceiling:	2.8	psf	
Mech/Misc:	2.5	psf	
Σ =	19.4	psf,	Say **20.0 psf**

*Load does not apply to metal deck

DL applied to Metal Deck: **15.0 psf**

Seismic Mass:

Average Roof D:	20.0	psf
Partitions	5.0	psf
Σ =	**25.0**	**psf**

Joist Point Load Allowance:	**500**	**lbs U.N.O., D**
Girder Point Load Allowance:	**3000**	**lbs, D**
Column Point Load Allowance:	**5000**	**lbs, D**

Loads applied at mechanical units/rooms in addition to basic roof load:
Mech. Unit Weight/Mass: **Actual weight as listed on plans.**

1st Floor:

Live (L) - Per IBC Table 1607.1:

Offices	50.0	psf
Classrooms	40.0	psf
First- Floor Corridors	100.0	psf

(E) Kindergarten Room
Dead (D)

Flooring	2.0	psf
5" Concrete Slab	60.0	psf
Mech/Misc.	3.0	psf
Σ =	**65.0**	**psf**

Walls:

Dead (D)/Seismic Mass:

	DL	
12" CMU Walls	**120.0**	**psf**
8" CMU Walls	**80.0**	**psf**

8.2 FOUNDATION DESIGN

Based on the assumed structural loading, proposed structure type, and soil conditions encountered during the subsurface exploration, foundation design parameters presented in Table 5 (Allowable Bearing Pressure) are recommended for project design.

Table 5: Allowable Bearing Pressure	
Allowable Bearing Pressures (psf)	
Footings bottomed at least 2 feet [(3)] below the proposed finished grade elevation on compacted structural fill or native granular soil	3,500
Allowable Friction Coefficient:	
For Cast-In-Place Concrete Foundations bottomed on structural fill or native granular soil	0.45
For Precast Concrete Foundations bottomed on structural fill or native granular soil	0.36
Allowable Passive Soil Pressure (psf/ft)	
Backfill soils consisting of compacted onsite granular soil or structural fill	295

NOTES:

1. Units:
   a. (psf): Pounds per square foot.
   b. (psf/ft): Pounds per foot of depth
2. Allowable Bearing Pressure:
   a. May be increased by one-third for total loading conditions, including wind and seismic forces.
   b. Is a net value, and the weight of the foundation extending below grade and backfill may be neglected when computing dead loads.
   c. Includes a minimum Factor of Safety (FOS) of 3.0 against bearing failure.
3. Minimum Foundation Width:
   a. The design is based on a minimum foundation width of 1 foot.
   b. Foundations shall be proportioned and located to maintain stability (e.g., bearing, overturning, sliding, uplift, eccentricity). Eccentric loading, where required, shall be evaluated for allowable bearing pressures.
   c. Overturning moments and uplift loading can be resisted by the weight of the foundation, weight of the structure, and any soil overlying the foundation.
4. Frost Protection for Footings:
   a. For frost protection, footings shall be set at least 2 feet below the adjacent exterior grade unless otherwise designed to resist uplift due to frost heave (e.g., PT slabs).
   b. Alternatively, foundations may be placed on non-frost susceptible material as defined in Section 4.2 (Foundations on Non-Frost Susceptible Ground or Fill Material) in ASCE 32. This non-frost susceptible material must extend below the jurisdictional frost line.
5. Passive Earth Pressure:
   a. The passive earth pressure is used as a triangular distribution.
   b. Frictional resistance and passive earth pressure provided in the table are "allowable" and can be used in combination without reduction. A factor of safety of 1.5 was applied.
   c. The material within the frost zone shall be neglected when designing for passive pressure.
   d. When sloping backfill is used near foundations, the design engineer shall contact the geotechnical engineer for additional recommendations.
   e. Lateral loads (such as wind or seismic) may be resisted by passive soil pressure and friction at the bottom of the footing.
6. Backfill Compaction:
   a. Assumes stem-wall backfill is compacted to at least 90 percent relative compaction (ASTM D1557).
7. Foundation Excavation Bottom:
   a. The bottom of all foundation excavations shall be free of ponded or standing water, frost, and loose or sloughing materials.
   b. CME recommends that footing excavations be observed by the project soils engineer prior to placing concrete reinforcing steel to confirm the subsurface conditions are similar to those described in this report.

Table 1608.2.1 Ground snow loads for Northern Nevada locations

*Add Table **1608.2.1** to read as follows:*

Table 1608.2.1

GROUND SNOW LOADS, Pg, FOR NORTHERN NEVADA LOCATIONS [1,2,3,4]

Elevation (feet)	West of U.S. 395, Eastern Sierra Slope, Carson City, Reno, Washoe County*, Douglas County and West of S.R. 88.[1]				East of U.S. 395 for Carson City, Reno, Sparks, Washoe County*, Douglas County and East of S.R. 88.[1]				Lyon County, City of Fernley				Storey County[1]				All Nevada Counties*, Lake Tahoe Basin, Western Sierra Slope			
	RISK CATEGORY																			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
	Pg (Pounds Per Square Foot)																			
4500	35	43	48	52	35	43	48	52	12	15	16	18	12	15	16	18				
5000	35	43	48	52	35	43	48	52	35	43	48	52	12	15	16	18				
5100	47	59	65	71	36	45	49	54	36	45	49	54	12	15	16	18				
5200	60	75	82	90	38	48	52	57	36	45	49	54	12	15	16	18				
5300	74	92	101	110	39	49	54	59	39	49	54	59	12	15	16	18				
5400	86	108	118	129	40	50	55	60	40	50	55	60	12	15	16	18				
5500	99	123	136	148	43	53	59	64	43	53	59	64	58	72	79	86				
6000	163	203	224	244	50	62	68	74	50	62	68	74	80	100	110	120	252	315	346	378
6500	196	245	269	294	50	62	68	74	50	62	68	74	103	129	142	155	269	336	370	403
7000	229	286	315	343	66	82	90	98	66	82	90	98	103	129	142	155	286	358	393	429
7500	246	308	338	369	66	82	90	98	66	82	90	98	103	129	142	155	303	379	417	455
8000	262	328	360	393	99	123	136	148	99	123	136	148	103	129	142	155	320	400	440	480
8500	278	348	382	417	99	123	136	148	99	123	136	148	103	129	142	155	338	422	464	506
9000	310	388	426	465	131	163	180	196	131	163	180	196	131	163	180	196	378	472	519	566
9500	343	429	472	515	163	203	224	244	163	203	224	244	138	172	189	206	446	558	613	669
10000	408	510	561	612	163	203	224	244	163	203	224	244	163	203	224	244	480	600	660	720

Footnotes:

1. Final roof snow design load Ps or Pf shall not be less than 29 psf

2. Refer to local jurisdiction ordinances for other Ground Snow Load information S.R. = State Route

3. Intermediate values may be determined by interpolation U.S. = U.S. Highway

4. The City of Elko shall not have ground snow loads less than 30 psf and Churchill County shall not have ground snow loads less than 20 psf

* Ground snow loads in Washoe County shall be taken from Tables 1608.2.1 or the ASCE Hazard Tool. Ground snow loads from the ASCE Hazard tool shall use the ASCE/SEI 7-22 standard. The minimum ground snow load for a structure shall not be less than the lower of the two values from Table 1608.2.1 and the ASCE Hazard Tool.

ASCE 7-22 Sections 7.7 and 7.8 Snow Drifts at Roof Projections and Lower Roofs

p_g (psf)	*48*
C_e =	*0.9*
$C_{t,\ heated}$ =	*1.19*
$C_{t,\ unheated}$ =	*1.20*
C_s =	*1.0*
W_2	*0.25*
Heated Roof, $p_{b,\ heated}$ (psf)	36.0
Unheated Roof, $p_{b,\ unheated}$ (psf)	36.3
Υ = Min(0.13p_g+14, 30), pcf	20.2
$h_{b,\ heated}$ (ft) = $p_{b,\ heated}/\Upsilon$ (ft)	1.8
$h_{b,\ unheated}$ (ft) = $p_{b,\ unheated}/\Upsilon$ (ft)	1.8

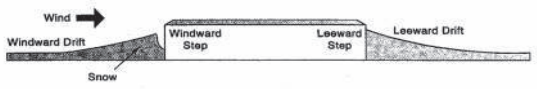


Figure 7.7-1. Drifts formed at windward and leeward steps.

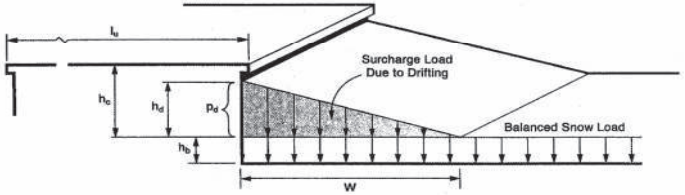


Figure 7.7-2. Configuration of snowdrifts on lower roofs.

Location	Projection Height (ft)	Heated or Unheated Roof?	h_c (ft)	h_b (ft)	Drift Req'd, $h_c/h_b \geq 0.2$?	Roof Lengths $l_{u,\ high}$ (ft)[1]	Roof Lengths $l_{u,low}$ (ft)[2]	Leeward Drift: h_d Min Eq. 7.6-1 ($l_{u,high}$) and $0.6l_{u,low}$	Leeward Drift: Drift Ht (ft)	Leeward Drift: Drift Width, w (ft)	Leeward Drift: p_d (psf)	Windward and Parapet Drift: $0.75h_d$ (Eq. 7.6-1) using $l_{u,low}$	Windward and Parapet Drift: Drift Ht (ft)[4]	Windward and Parapet Drift: Drift Width, w (ft)	Windward and Parapet Drift: p_d (psf)	Max Drift Values: p_d (psf)	Max Drift Values: w (ft)[3]	Max Drift Values: p_d+p_b (psf)	Query: Query Dist From Max (ft)	Query: p_d+p_s (psf)
Grid 4 Parapet	*4*	*Heated*	2.2	1.8	Yes		*70*	0.0	0.0	0.0	0.0	1.4	1.4	8.6	28.9	28.9	8.6	64.8		65
Grid 3 High Roof Parapet	*4*	*Heated*	2.2	1.8	Yes		*59*	0.0	0.0	0.0	0.0	1.3	1.3	8.1	27.2	27.2	8.1	63.2		63
Grid 1 Parapet	*3*	*Heated*	1.2	1.8	Yes		*70*	0.0	0.0	0.0	0.0	1.4	1.2	8.6	24.7	24.7	8.6	60.7		61
Grid 2 Parapet	*3*	*Heated*	1.2	1.8	Yes		*37*	0.0	0.0	0.0	0.0	1.1	1.1	6.8	23.1	23.1	6.8	59.1		59
Grid B and C Parapets	*5*	*Heated*	3.2	1.8	Yes		*71*	0.0	0.0	0.0	0.0	1.4	1.4	8.6	29.0	29.0	8.6	65.0		65
Grid A and D Parapets	*4*	*Heated*	2.2	1.8	Yes		*78*	0.0	0.0	0.0	0.0	1.5	1.5	8.9	30.0	30.0	8.9	66.0		66
Grid B.3 High Roof Parapet	*4*	*Heated*	2.2	1.8	Yes		*26*	0.0	0.0	0.0	0.0	1.0	1.0	6.0	20.4	20.4	6.0	56.4		56
Grid 3 Low Roof	*19*	*Heated*	17.2	1.8	Yes	*61*	*12*	1.8	1.8	7.2	36.7	0.8	0.8	4.6	15.6	36.7	7.2	72.7		73
Grid B.3 Low Roof	*19*	*Heated*	17.2	1.8	Yes	*28*	*52*	1.4	1.4	5.5	27.9	1.3	1.3	7.7	26.0	27.9	7.7	63.9		64
				1.8	######			#VALUE!	######	######	####	#VALUE!	#####	######	######	#VALUE!	######	#####		

1. $l_{u,\ high}$: High Roof Length (ft), Fetch opposite vertical face
2. $l_{u,\ low}$: Low Roof Length (ft), Fetch facing vertical face
3. Controlling Drift Width is taken as max of leeward and windward. This is conservative since the windward width is not required to be applied to the leeward drift.
4. Windward/Parapet Drift Ht. is taken as minimum of h_c and $0.75h_d$

Table 1609.3.2 Special wind region defined: minimum basic wind speeds

*Add Table **1609.3.2** to read as follows:*

TABLE 1609.3.2
SPECIAL WIND REGION DEFINED:
MINIMUM BASIC WIND SPEEDS

For Carson City, City of Reno, City of Sparks, Douglas, Lyon, Storey and Washoe Counties the design wind speed values shall be:

Risk Category	Ultimate Wind Speed V_{ult} (mph)	V_{asd} Wind Speed 3-sec gust (mph)
I	110	85
II & 2024 IRC	120	93
III	130	101
IV	135	104

Table notes:

a) Air density corrections to design wind pressures are prohibited. The conversions from Vult to Vasd are based on Table 1609.3.1

Section 1704.2 Special inspections and tests

*Amend Section **1704.2** to read as follows:*

1704.2 Special inspections and tests. Where application is made to the *building official* for construction as specified in Section 105, the *owner* or the *owner's* authorized agent, other than the contractor, shall employ one or more *approved agencies* to provide *special inspections* and tests during construction on the types of work specified in Section 1705 and identify the *approved agencies* to the *building official*. These *special inspections* and tests are in addition to the inspections by the *building official* that are identified in Section 110.

Exceptions:

1. *Special inspections* and tests are not required for construction of a minor nature or as warranted by conditions in the *jurisdiction* as *approved* by the *building official*.

2. Unless otherwise required by the *building official*, *special inspections* and tests are not required for Group R-3 occupancies as applicable in section 101.2 and Group U occupancies that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.

3. *Special inspections* and tests are not required for portions of *structures* designed and constructed in accordance with the cold-formed steel *light-frame construction* provisions of Section 2206.1.2 or the *conventional light-frame constructions* provisions of Section 2308.

4. The contractor is permitted to employ the *approved agencies* where the contractor is also the *owner*.

MWFRS Per ASCE 7-22 Chapter 28: Envelope Procedure

Description: Wind Loads at Enclosed, Partially Enclosed, and Partially Open Buildings

Parameter	Value	ASCE 7-22 Ref.	
V (mph)	*130*		
Exposure Category	*C*		
Mean Roof Ht., h (ft)	*32*		
Roof Angle (degrees)	*2.4*		
Enclosure Class.	*Enclosed*	26.7	
K_d	*0.85*	26.6	
K_{zt}	*1.0*	26.8.2	
K_e	*1.0*		
K_z	*0.99*	26.10	
Gcpi (±)	*0.18*	26.13	Enter as positive value
Gcp Overhang	*-0.70*	28.3.5	Upward on Bottom
Least Horiz. Dim. (ft)	*127*		Future
q_h (psf)	42.8	Eq. 26.10-1	
a (ft)	**13**		

Main Wind-Force Resisting System Pressures

Building Surface	Load Case	$GC_{pf, pn}$	$p_{s,p}$ (psf)
1	1	*0.4*	**21.1**
	2	*-0.45*	**-22.9**
2	1	*-0.69*	**-31.7**
	2	*-0.69*	**-31.7**
3	1	*-0.37*	**-20.0**
	2	*-0.37*	**-20.0**
4	1	*-0.29*	**-17.1**
	2	*-0.45*	**-22.9**
5	1	*-*	**-**
	2	*0.4*	**21.1**
6	1	*-*	**-**
	2	*-0.29*	**-17.1**
1E	1	*0.61*	**28.8**
	2	*-0.48*	**-24.0**
2E	1	*-1.07*	**-45.5**
	2	*-1.07*	**-45.5**
3E	1	*-0.53*	**-25.8**
	2	*-0.53*	**-25.8**
4E	1	*-0.43*	**-22.2**
	2	*-0.48*	**-24.0**
5E	1	*-*	**-**
	2	*0.61*	**28.8**

6E	1	-	**-**
	2	*-0.43*	**-22.2**
2 Overhang	1	-1.39	**-50.6**
	2	-1.39	**-50.6**
3 Overhang	1	-1.07	**-39.0**
	2	-1.07	**-39.0**
2E Overhang	1	-1.77	**-64.4**
	2	-1.77	**-64.4**
3E Overhang	1	-1.23	**-44.8**
	2	-1.23	**-44.8**
Windward Parapet	-	1.5	**54.6**
Leeward Parapet	-	-1	**-36.4**

Wind on Components and Cladding Per ASCE 7-22 Chapter 30, Part 1: Low-Rise Buildings

Description: Wind Loads at Enclosed, Partially Enclosed, and Partially Open Buildings (Figure 30.3-2A)

Parameter	Value	ASCE 7-22 Ref.	
V (mph)	*130*		
Exposure Category	*C*	26.7	
Mean Roof Ht., h (ft)	*32*		
Roof Angle (degrees)	*2.4*		
Enclosure Class.	*Enclosed*	26.2	
K_d	*0.85*	26.6	
K_{zt}	*1.0*	26.8.2	
K_e	*1.0*		
K_h	*0.99*	26.10	
Gcpi (±)	*0.18*	26.13	Enter as positive value
Gcp Overhang	*-0.70*	28.3.5	Upward on Bottom
Least Horiz. Dim. (ft)	*127*		Future
Roof Shape	*Flat*		
Roof Figure	*30.3-2A*		
Overhang Figure	*30.3-2A*		
q_h (psf)	42.8	Eq. 26.10-1	
a (ft)	**13**		
0.6h (ft)	**19**		

Component and Cladding Wind Pressures

Zone	Effective Wind Area (sf)	GC_p (+)	GC_p (-)	+ p (psf)	- p (psf)
1'	10	*0.3*	*-0.9*	**17.5**	**-39.3**
1'	20	*0.25*	*-0.9*	**15.7**	**-39.3**
1'	50	*0.22*	*-0.9*	**14.6**	**-39.3**
1'	100	*0.2*	*-0.9*	**13.8**	**-39.3**
1'	200	*0.2*	*-0.75*	**13.8**	**-33.9**
1'	500	*0.2*	*-0.55*	**13.8**	**-26.6**
1	10	*0.3*	*-1.7*	**17.5**	**-68.4**
1	20	*0.25*	*-1.6*	**15.7**	**-64.8**
1	50	*0.22*	*-1.4*	**14.6**	**-57.5**
1	100	*0.2*	*-1.3*	**13.8**	**-53.9**
1	200	*0.2*	*-1.15*	**13.8**	**-48.4**
1	500	*0.2*	*-1*	**13.8**	**-43.0**
2	10	*0.3*	*-2.3*	**17.5**	**-90.3**
2	20	*0.25*	*-2.15*	**15.7**	**-84.8**
2	50	*0.22*	*-1.95*	**14.6**	**-77.5**
2	100	*0.2*	*-1.75*	**13.8**	**-70.3**
2	200	*0.2*	*-1.61*	**13.8**	**-65.2**
2	500	*0.2*	*-1.4*	**13.8**	**-57.5**
3	10	*0.3*	*-3.2*	**17.5**	**-123.1**
3	20	*0.25*	*-2.9*	**15.7**	**-112.1**
3	50	*0.22*	*-2.45*	**14.6**	**-95.7**

3	100	*0.2*	*-2.15*	**13.8**	**-84.8**
3	200	*0.2*	*-1.8*	**13.8**	**-72.1**
3	500	*0.2*	*-1.4*	**13.8**	**-57.5**
4	10	*1.0*	*-1.1*	**43.0**	**-46.6**
4	20	*0.95*	*-1.05*	**41.1**	**-44.8**
4	50	*0.88*	*-0.98*	**38.6**	**-42.2**
4	100	*0.82*	*-0.92*	**36.4**	**-40.0**
4	200	*0.77*	*-0.88*	**34.6**	**-38.6**
4	500	*0.7*	*-0.8*	**32.0**	**-35.7**
5	10	*1.0*	*-1.4*	**43.0**	**-57.5**
5	20	*0.95*	*-1.3*	**41.1**	**-53.9**
5	50	*0.88*	*-1.15*	**38.6**	**-48.4**
5	100	*0.82*	*-1.05*	**36.4**	**-44.8**
5	200	*0.77*	*-0.95*	**34.6**	**-41.1**
5	500	*0.7*	*-0.8*	**32.0**	**-35.7**

Wind on Components and Cladding Overhangs Per ASCE 7-22 Section 30.7

For Enclosed, Partially Enclosed, and Partially Open Buildings

Use GCp valuse from Fig. 30.3-2A

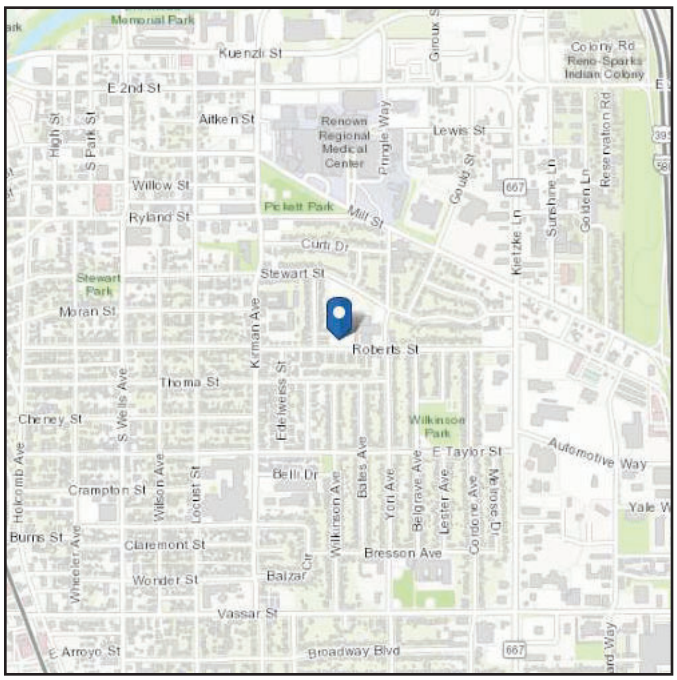
C&C Pressures on Roof Overhangs

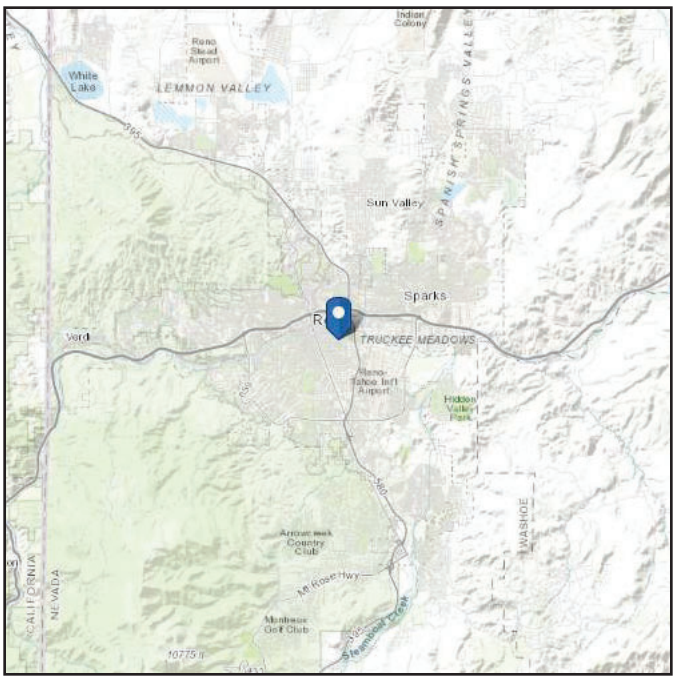
Zone	Effective Wind Area (sf)	GC_p (-)	p (psf)
1'	10	*-1.7*	**-68.4**
1'	20	*-1.65*	**-66.6**
1'	50	*-1.61*	**-65.2**
1'	100	*-1.6*	**-64.8**
1'	200	*-1.3*	**-53.9**
1'	500	*-1*	**-43.0**
1	10	*-1.7*	**-68.4**
1	20	*-1.65*	**-66.6**
1	50	*-1.61*	**-65.2**
1	100	*-1.6*	**-64.8**
1	200	*-1.3*	**-53.9**
1	500	*-1*	**-43.0**
2	10	*-2.3*	**-90.3**
2	20	*-2.1*	**-83.0**
2	50	*-1.8*	**-72.1**
2	100	*-1.6*	**-64.8**
2	200	*-1.35*	**-55.7**
2	500	*-1.1*	**-46.6**
3	10	*-3.2*	**-123.1**
3	20	*-2.81*	**-108.9**
3	50	*-2.31*	**-90.7**
3	100	*-1.95*	**-77.5**
3	200	*-1.6*	**-64.8**
3	500	*-1.1*	**-46.6**

ASCE Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-22	**Latitude:**	39.520437
Risk Category:	III	**Longitude:**	-119.795482
Soil Class:	C - Very Dense Soil and Soft Rock	**Elevation:**	4462.300040395303 ft (NAVD 88)





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Seismic

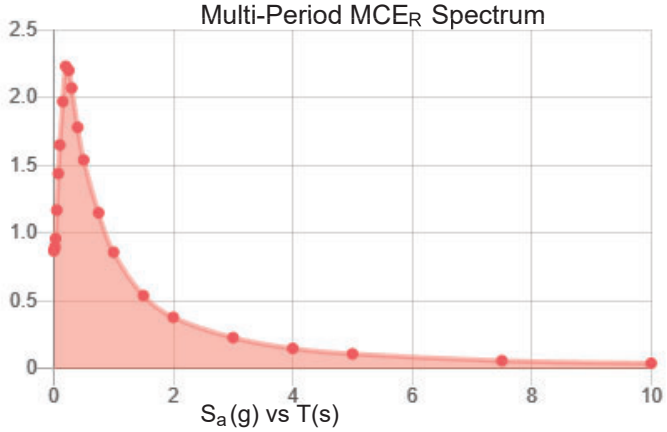
Site Soil Class: C - Very Dense Soil and Soft Rock

Results:

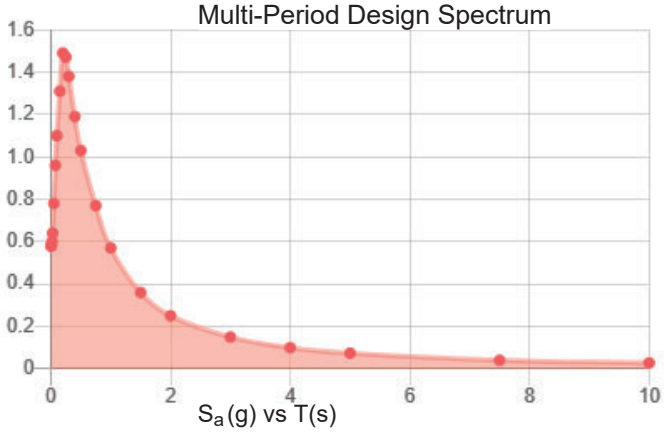
PGA_M :	0.73	T_L :	6
S_{MS} :	2.01	S_S :	1.96
S_{M1} :	0.86	S_1 :	0.6
S_{DS} :	1.34	V_{S30} :	530
S_{D1} :	0.57		

Seismic Design Category: D

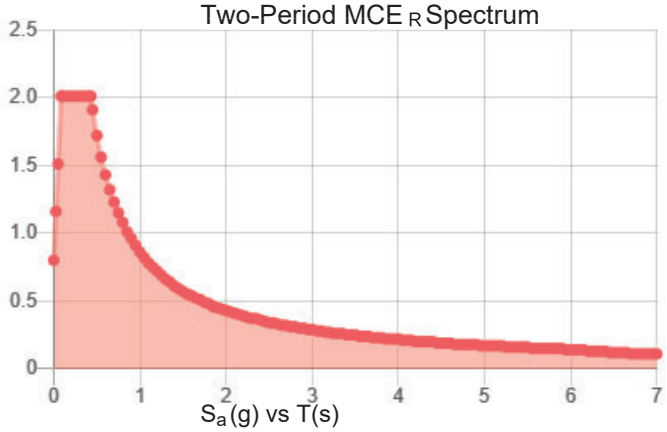
Multi-Period MCE_R Spectrum



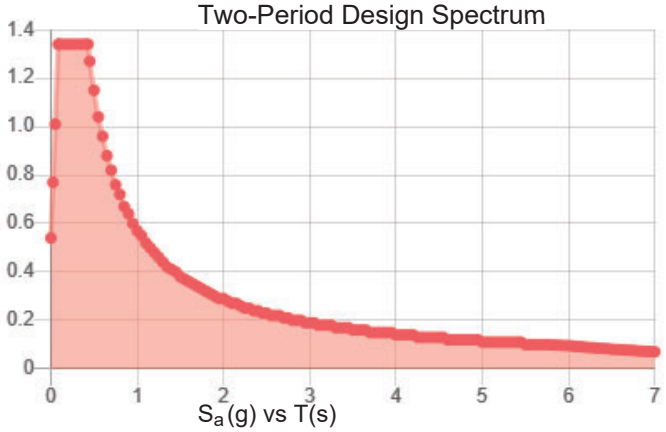
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: Tue Feb 24 2026

Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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Seismic Analysis Criteria per ASCE 7-22 Chapters 11 and 12

ASCE 7 Section

11.6 Seismic Design Category

Seismic Design Category is D.

12.2 Structural System Selection

12.2.1 Systems in Building (Ref. Table 12.2-1)

SFRS	R	Ω_0	C_d	SDC D h_n Limit (ft)
A7. Special Reinforced Masonry Shear Walls	***5***	***2****	***3.5***	***160***

*See Table 12.2-1 Footnote b.

12.2.2 Combinations of Framing Systems in Different Directions

N/A

12.2.3 Combinations of Framing Systems in the Same Direction

N/A

12.2.3.1 Seismic Coefficients for Vertical Combinations

N/A

12.2.3.3 Seismic Coefficients for Horizontal Combinations

N/A

12.3 Diaph. Flexibility, Configuration Irregularities, and Redundancy

12.3.1 Diaphragm Flexibility

12.3.1.1 Flexible Diaphragm Condition

Roof Diaphragm will be idealized as flexible.

12.3.2 Irregular and Regular Classification

12.3.2.1 Horizontal Structural Irregularities (Reference Table 12.3-1)

Type	**Occurs?**
1a	***No***
1b	***No***
2	***No***
3	***No***
4	***No***
5	***No***

12.3.2.2 Vertical Irregularites (Reference Table 12.3.2)

Type	**Occurs?**
1a	***No***
1b	***No***
2	***No***
3	***No***
4	***No***
5a	***No***
5b	***No***

12.3.4 Redundancy

12.3.4.2 Redundancy Factor for SDC D through F

$\rho = 1.0$

12.5 Direction of Loading

12.5.4 SDC D through F

The independent directional procedure of 12.5.1.1 will be used.

12.6 Analysis Procedure Selections

The Equivalent Lateral Force Procedure will be used.

12.8 Equivalent Lateral Force Procedure

V = CsW *(Eq. 12.8-1)*

12.8.1.1 Calculation of Cs (Method 2)

Risk Category:	***III***		*(See Table 1.5-1)*
I_e =	***1.25***		*(See Table 1.5-2)*
Seismic Site Class	**C**		*(See Geotech Report)*
S_{DS} =	***1.34***		*See Attached.*
S_{D1} =	***0.57***		*See Attached.*
S_1 =	***0.6***		*See Attached.*
T_L =	***6***	sec.	*See Attached.*
	$T < T_L$		*(See 12.8.2.1 Below)*
C_s =	$S_{DS}/(R/I_e)$		*(Eq. 12.8-3)*
For $T \le T_L$, C_{smax} =	$S_{D1}/(T(R/I_e))$		*(Eq. 12.8-6)*
C_{smin} = Max:	$0.044S_{DS}I_e$		*(Eq. 12.8-6)*
	0.1		
	For $S_1 \ge 0.6$, $0.5S_1/(R/I_e)$		

SFRS	R	Eq. 12.8-2	C_{smin}	C_{smax}	$C_{s,\ controls}$
A7. Special Reinforced Masonry Shear Walls	**5**	**0.34**	**0.08**	**0.53**	**0.34**

12.8.2 Period Determination

The approximate fundamental period per 12.8.2.1 will be used for ELF Procedure.

12.8.2.1 Approximate Fundamental Period

$T_a = C_t h_n^x$ =	0.27		*(Eq. 12.8-8)*
C_t =	***0.02***		*(Table 12.8-2)*
h_n =	***32***	ft	
x =	***0.75***		*(Table 12.8-2)*

Non-Composite OWJ Roof Design

Loads on all Joists

Roof Dead Load (psf)	*20*

Description	Span (ft)	Trib Width (ft)	Equiv. 0.7Snow/ Live Load (psf)	Point Load (D) at Midspan (lb)	Point Load (L) at Midspan (lb)	Total Uniform Load (plf)	Unif. Live Load (plf)	Moment (lb-ft) Uniform + Point Loads	Equivalent Uniform Loads: TL For Bending (plf)	Equivalent Uniform Loads: TL For Deflection (plf)	Equivalent Uniform Loads: LL For Deflection (plf)	**Min Joist to Use**	Allow Total Uniform Load (plf)	Total Load Code Check	Allow LL for Δ ≤ L/360	LL Deflection Code Check	Allow TL for Δ ≤ L/240	TL Deflection Code Check	Notes/Bridging*
(B-C)-(1-2)	*34*	*7.7*	*29*	*500*		377	223.3	58770	407	401	223	***28LH05***	*472*	0.86	*415*	0.54	623	0.64	***(3) Rows Bridging***
(B.3-D)-(2-3)	*26*	*8.1*	*31*	*500*		413	251.1	38157	452	444	251	***24LH03***	*590*	0.77	*530*	0.47	795	0.56	***(2) Rows Bridging***
(A-B.3)-(2-4)	*37*	*8.1*	*30*	*500*		405	243	73931	432	427	243	***32LH06***	*537*	0.80	*524*	0.46	786	0.54	***(2) Rows Bridging***
						0	0	0	#DIV/0!	#DIV/0!	#DIV/0!			####		#####	0	#DIV/0!	

Total number of bottom chord bridging lines shall not be less than top chord bridging.
Where net uplift occurs, bottom chord bridging is required near first bottom chord panel point.

ASD

STANDARD LOAD TABLE/OPEN WEB STEEL JOISTS, LH-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown In Pounds Per Linear Foot (plf)

Joist Designation	24LH03	24LH04	24LH05	24LH06	24LH07	24LH08	24LH09	24LH10	24LH11	24LH12	24LH13	24LH14	24LH15	24LH16	24LH17	24LH18	24LH19	24LH20	24LH21
Depth (in.)	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Approx. Wt. (lbs./ft.)	11	12	13	16	17	18	21	23	25	27	32	35	38	42	49	57	62	79	88
Span (ft.) ↓																			
24	664	723	827	1041	1214	1287	1661	1784	1948	2235	2688	2936							
	664	723	827	1041	1214	1287	1618	1716	1796	2235	2688	2936							
25	626	681	779	981	1140	1208	1555	1670	1824	2093	2511	2743	2972						
	598	681	779	981	1140	1208	1429	1515	1587	2093	2445	2660	2893						
26	590	642	735	925	1072	1136	1458	1565	1710	1962	2350	2567	2782						
	530	642	695	925	1020	1083	1268	1345	1408	1864	2171	2361	2568						
27	557	606	694	874	1009	1069	1369	1469	1607	1843	2203	2407	2608						
	473	580	620	827	910	966	1131	1199	1256	1662	1935	2105	2290						
28	527	573	656	827	948	1008	1288	1382	1511	1734	2069	2260	2449	2835					
	423	519	555	741	814	865	1013	1074	1124	1488	1733	1885	2050	2263					
29	498	542	621	782	895	951	1216	1302	1423	1633	1946	2126	2304	2641					
	381	467	499	666	732	778	910	965	1011	1338	1558	1695	1843	2035					
30	472	514	588	741	848	899	1144	1228	1341	1540	1833	2002	2170	2466	2819				
	343	421	450	601	661	702	821	871	912	1207	1406	1529	1663	1836	2094				
31	448	487	555	703	800	850	1084	1160	1264	1455	1729	1889	2047	2308	2638				
	311	381	408	544	598	635	744	789	826	1093	1272	1384	1505	1662	1895				
32	425	462	521	667	748	806	1020	1072	1166	1376	1633	1785	1934	2164	2474	2860			
	282	346	370	494	543	577	675	716	750	993	1156	1257	1367	1509	1721	1964			
33	404	440	492	635	706	764	955	995	1054	1304	1545	1689	1830	2034	2325	2688			
	257	315	337	450	495	525	615	652	683	904	1053	1145	1245	1375	1568	1790			
34	342	419	449	604	665	707	832	882	927	1236	1464	1600	1734	1915	2189	2530	2832		
	235	288	308	411	452	480	562	596	624	826	962	1046	1138	1256	1432	1635	1804		
35	339	398	446	579	638	677	808	856	900	1174	1389	1517	1644	1806	2064	2386	2671		
	226	265	297	382	421	447	530	559	588	756	881	958	1042	1150	1312	1497	1653		
36	336	379	440	555	613	649	785	832	875	1115	1319	1441	1562	1706	1950	2255	2523		
	218	246	285	356	393	416	501	528	555	695	809	880	957	1056	1205	1375	1518		
37	323	360	419	530	588	622	764	809	851	1061	1254	1370	1485	1614	1845	2133	2387	2982	
	204	227	264	331	367	388	460	500	525	639	744	810	881	972	1109	1265	1397	1729	
38	307	343	399	504	565	597	731	788	829	1009	1193	1298	1413	1530	1749	2021	2262	2826	
	188	210	244	306	343	362	424	474	498	590	687	747	812	897	1023	1167	1288	1595	
39	293	327	380	480	541	572	696	768	807	957	1135	1232	1346	1451	1659	1918	2147	2682	2993
	175	195	226	284	320	338	393	439	472	545	635	690	751	829	945	1079	1191	1474	1631
40	279	312	363	457	516	545	663	737	787	910	1078	1170	1279	1379	1577	1823	2040	2548	2844
	162	182	210	263	297	314	363	406	449	505	588	639	695	768	876	999	1103	1365	1510
41	267	298	347	437	491	520	632	702	768	865	1026	1113	1217	1312	1500	1734	1941	2424	2706
	152	169	196	245	276	292	337	378	418	468	545	593	645	712	813	927	1024	1267	1402
42	255	285	331	417	468	497	602	668	734	824	977	1061	1159	1250	1429	1652	1849	2309	2578
	141	158	182	228	257	272	313	351	388	435	507	552	600	662	755	862	952	1178	1303
43	244	273	317	399	446	475	574	637	701	786	932	1011	1105	1192	1363	1575	1763	2202	2458
	132	148	171	211	239	254	292	326	361	406	472	514	559	617	704	803	886	1097	1214
44	234	262	304	381	426	455	548	608	671	751	890	966	1055	1138	1301	1504	1683	2103	2347
	124	138	160	197	223	238	272	304	337	378	440	479	521	575	656	749	827	1023	1132
45	224	251	291	364	407	435	524	582	642	717	850	923	1009	1088	1243	1437	1609	2009	2243
	116	130	150	184	208	222	254	285	315	353	412	448	487	538	613	700	772	956	1058
46	215	241	280	348	389	417	501	556	616	686	813	883	965	1041	1190	1375	1539	1922	2146
	109	122	141	172	195	208	238	266	294	331	385	419	456	503	574	655	723	895	990
47	207	231	269	334	373	400	480	533	590	657	779	845	924	996	1139	1317	1474	1841	2055
	102	114	132	161	182	196	223	249	276	310	361	393	427	471	538	614	677	838	927
48	199	222	258	320	357	384	460	511	567	630	747	810	886	955	1092	1262	1412	1764	1969
	96	107	124	152	171	184	209	234	259	291	339	368	401	442	504	576	636	787	870

ASD

STANDARD LOAD TABLE/OPEN WEB STEEL JOISTS, LH-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown In Pounds Per Linear Foot (plf)

Joist Designation	28LH05	28LH06	28LH07	28LH08	28LH09	28LH10	28LH11	28LH12	28LH13	28LH14	28LH15	28LH16	28LH17	28LH18	28LH19	28LH20	28LH21	28LH22	28LH23
Depth (in.)	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Approx. Wt. (lbs./ft.)	13	16	17	18	21	23	25	27	30	35	38	42	49	56	63	79	88	102	111
Span (ft.) ↓																			
28	626	831	968	1036	1342	1438	1570	1839	2034	2459	2665								
	626	831	968	1036	1342	1438	1570	1839	1944	2459	2665								
29	596	791	920	983	1271	1362	1487	1741	1922	2324	2518	2962							
	596	791	920	983	1271	1362	1487	1674	1747	2324	2518	2839							
30	568	755	874	934	1204	1291	1409	1651	1818	2199	2383	2798							
	568	755	874	934	1186	1291	1380	1510	1576	2130	2317	2561							
31	542	720	831	889	1143	1225	1337	1566	1722	2083	2257	2647							
	542	720	818	873	1074	1169	1249	1367	1427	1928	2098	2319							
32	517	687	791	846	1085	1163	1270	1488	1633	1975	2140	2507	2888						
	499	658	743	793	975	1062	1134	1242	1296	1751	1905	2106	2406						
33	494	656	753	806	1032	1106	1207	1414	1550	1875	2032	2377	2738						
	454	600	677	722	888	967	1033	1131	1181	1595	1735	1918	2192						
34	472	627	718	768	982	1052	1149	1346	1474	1782	1931	2257	2592	2936					
	415	548	618	660	811	883	944	1033	1079	1457	1585	1752	2002	2286					
35	451	600	685	733	935	1002	1094	1282	1402	1695	1837	2137	2445	2791					
	380	502	566	604	743	809	865	946	988	1335	1452	1605	1834	2094					
36	432	574	654	700	892	956	1043	1223	1335	1614	1750	2018	2310	2655	2995				
	349	461	520	555	682	743	794	869	907	1226	1333	1474	1684	1923	2127				
37	414	550	625	669	851	912	996	1166	1272	1539	1668	1910	2186	2527	2833				
	321	424	478	511	628	684	731	800	835	1128	1227	1356	1550	1770	1958				
38	396	527	598	640	813	871	951	1113	1214	1468	1591	1810	2071	2395	2685				
	296	391	441	471	579	631	674	738	770	1040	1132	1251	1429	1632	1806				
39	380	505	573	612	777	833	909	1065	1160	1402	1520	1717	1965	2273	2548				
	274	362	408	435	536	583	623	682	712	962	1046	1157	1321	1509	1670				
40	365	485	549	587	743	797	870	1019	1108	1340	1453	1632	1867	2159	2421				
	254	335	378	403	496	540	577	632	659	891	969	1071	1224	1398	1546				
41	350	466	526	562	708	763	833	976	1060	1282	1390	1553	1777	2055	2303	2884			
	236	311	351	374	460	501	536	586	612	827	899	994	1136	1297	1435	1782			
42	337	448	505	540	667	729	780	857	895	1228	1331	1479	1692	1957	2194	2747			
	219	289	326	348	428	466	498	545	569	769	836	924	1056	1206	1334	1657			
43	323	429	484	517	639	704	762	837	874	1177	1275	1410	1614	1866	2092	2620	2925		
	205	270	305	325	400	439	475	520	543	716	779	861	983	1123	1243	1543	1708		
44	310	412	464	496	612	679	736	818	854	1129	1223	1346	1541	1782	1998	2501	2793		
	192	253	285	305	375	414	448	496	518	668	726	803	917	1048	1159	1439	1593		
45	297	395	445	475	586	651	711	800	835	1083	1174	1287	1473	1703	1909	2390	2669	2936	
	180	238	267	285	351	388	423	476	495	624	679	750	857	979	1083	1345	1489	1688	
46	286	379	427	456	563	625	682	782	816	1040	1128	1231	1409	1629	1827	2287	2553	2808	
	169	223	251	268	329	364	397	454	472	584	635	702	802	916	1013	1258	1393	1579	
47	275	364	410	438	540	600	655	766	799	999	1084	1179	1349	1560	1749	2190	2445	2689	
	159	209	236	252	309	342	373	435	452	547	595	658	751	858	950	1179	1305	1480	
48	265	350	394	420	519	576	629	737	782	958	1043	1130	1293	1495	1676	2099	2344	2578	2950
	150	197	222	236	291	322	351	408	433	513	558	617	705	805	891	1106	1225	1389	1510
49	255	337	379	403	499	554	605	709	766	919	1004	1084	1240	1434	1608	2014	2248	2473	2836
	142	186	209	222	274	303	331	383	415	482	525	580	663	757	837	1040	1151	1305	1419
50	245	324	365	387	481	533	582	682	751	882	964	1041	1191	1377	1544	1933	2159	2374	2727
	133	175	197	209	258	285	312	361	396	454	493	546	623	712	788	978	1083	1228	1335
51	237	313	352	371	463	513	561	656	722	848	926	1000	1144	1323	1484	1858	2074	2281	2625
	126	166	186	196	243	269	294	340	373	427	465	514	587	670	742	921	1020	1156	1257
52	228	301	339	357	446	495	540	632	694	815	891	962	1101	1273	1427	1786	1995	2194	2529
	119	156	176	185	228	255	278	321	352	403	438	485	554	632	700	869	962	1090	1186
53	220	291	327	344	430	477	521	609	668	784	857	925	1059	1225	1373	1719	1920	2111	2437
	113	148	166	175	216	241	263	303	332	380	414	457	523	597	660	820	908	1029	1119
54	213	281	316	331	415	460	502	587	643	755	826	891	1020	1180	1322	1656	1849	2033	2351
	107	140	158	165	204	228	249	285	314	359	391	432	494	564	624	775	858	973	1058
55	206	271	305	319	401	444	485	566	620	728	796	859	983	1137	1275	1596	1782	1960	2269
	102	133	150	156	193	215	236	270	297	340	370	409	467	534	591	733	812	921	1001
56	199	262	295	308	387	429	468	546	598	702	767	828	948	1096	1229	1539	1718	1890	2191
	97	126	142	148	183	204	223	256	281	322	350	387	443	505	559	695	769	872	948

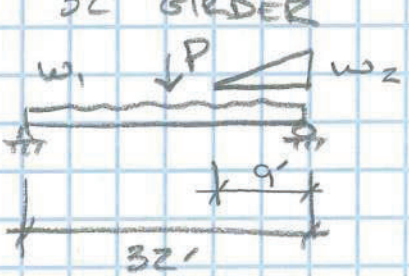
ASD

STANDARD LOAD TABLE/OPEN WEB STEEL JOISTS, LH-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown In Pounds Per Linerar Foot (plf)

Joist Designation	32LH06	32LH07	32LH08	32LH09	32LH10	32LH11	32LH12	32LH13	32LH14	32LH15	32LH16	32LH17	32LH18	32LH19	32LH20	32LH21	32LH22	32LH23	32LH24
Depth (in.)	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Approx. Wt. (lbs./ft.)	14	16	17	21	21	24	27	30	33	35	42	49	56	62	78	87	101	110	124
Span (ft.) ↓																			
32	655	735	829	1099	1184	1296	1522	1789	1916	2050	2691								
	655	735	829	1099	1184	1296	1522	1789	1916	2050	2691								
33	629	705	793	1049	1131	1238	1453	1705	1827	1954	2561	2951							
	629	705	793	1049	1131	1238	1453	1705	1827	1870	2553	2920							
34	605	678	760	1003	1080	1183	1388	1627	1742	1864	2440	2812							
	605	678	760	1003	1080	1183	1388	1605	1653	1708	2332	2668							
35	581	651	728	959	1033	1131	1328	1553	1663	1779	2326	2681							
	581	651	728	938	1033	1131	1323	1470	1514	1564	2136	2443							
36	559	626	698	917	989	1082	1271	1484	1589	1700	2220	2558	2890						
	559	626	689	861	950	1040	1215	1350	1391	1437	1961	2244	2563						
37	537	602	670	878	947	1036	1217	1419	1519	1626	2120	2443	2760						
	524	584	634	793	875	957	1118	1243	1280	1322	1805	2065	2359						
38	517	580	643	842	907	993	1166	1358	1454	1555	2026	2335	2638						
	484	539	585	731	807	883	1032	1146	1181	1220	1665	1905	2176						
39	498	558	617	807	870	952	1118	1300	1392	1490	1938	2234	2524	2890					
	447	498	540	676	746	816	954	1060	1091	1127	1539	1761	2012	2230					
40	479	538	593	774	834	913	1073	1246	1334	1427	1856	2139	2416	2763					
	414	461	501	626	691	756	883	981	1011	1044	1426	1631	1863	2066					
41	462	518	570	743	801	877	1030	1195	1279	1369	1778	2049	2315	2644					
	384	428	465	581	641	701	820	911	938	969	1323	1513	1729	1917					
42	445	499	549	714	770	842	989	1146	1228	1314	1705	1956	2220	2532					
	357	398	432	540	596	652	762	847	872	901	1230	1407	1608	1782					
43	430	482	528	687	740	810	951	1101	1179	1262	1629	1865	2130	2422					
	333	371	402	503	555	607	710	789	812	839	1146	1310	1497	1660					
44	414	465	509	660	712	779	915	1058	1133	1212	1555	1781	2046	2312	2900				
	310	346	375	469	518	567	662	736	758	783	1069	1222	1397	1548	1927				
45	400	449	490	636	685	750	880	1017	1089	1166	1486	1702	1966	2210	2771				
	290	323	351	439	484	529	619	687	708	731	998	1142	1305	1447	1801				
46	386	433	473	612	660	722	848	979	1048	1122	1422	1628	1883	2114	2651	2961			
	271	302	328	410	453	495	579	643	663	684	934	1069	1221	1354	1685	1866			
47	373	419	456	590	636	696	817	943	1009	1080	1361	1559	1803	2025	2539	2835			
	254	283	307	385	424	464	542	603	621	641	875	1001	1144	1268	1579	1749			
48	361	405	440	566	613	671	788	908	972	1040	1305	1494	1729	1940	2433	2718	2990		
	239	266	288	361	398	436	509	566	583	602	821	940	1074	1190	1482	1641	1862		
49	349	391	425	544	591	647	760	875	937	1003	1252	1434	1658	1862	2334	2607	2869		
	224	250	271	339	374	409	478	531	547	565	772	883	1009	1118	1392	1542	1750		
50	338	379	411	516	571	625	734	817	843	870	1202	1376	1592	1787	2241	2503	2754		
	211	235	255	319	352	385	450	500	515	532	726	831	949	1052	1310	1451	1646		
51	326	366	397	498	550	602	712	801	826	853	1155	1323	1530	1717	2154	2405	2647	2985	
	199	223	242	302	332	363	428	480	495	511	684	782	894	991	1234	1366	1550	1689	
52	315	353	383	480	531	580	688	785	810	837	1111	1272	1471	1652	2071	2313	2545	2877	
	189	211	229	285	315	343	406	461	476	492	645	738	843	935	1163	1288	1462	1593	
53	304	341	369	463	512	560	664	771	795	821	1069	1224	1416	1589	1993	2226	2449	2775	2921
	179	200	216	270	297	325	384	444	458	473	609	697	796	882	1098	1216	1380	1504	1628
54	294	329	357	447	495	541	641	742	780	805	1029	1179	1364	1531	1920	2144	2359	2679	2813
	169	189	205	256	282	308	364	420	440	454	575	658	752	834	1038	1150	1305	1421	1539
55	284	318	345	432	478	522	619	715	766	791	992	1136	1314	1475	1850	2066	2273	2587	2711
	161	179	194	243	267	292	345	397	417	438	544	623	712	789	982	1088	1234	1344	1456
56	275	308	333	418	462	505	598	690	738	776	957	1096	1267	1423	1784	1993	2192	2499	2614
	153	170	184	230	254	277	327	376	395	422	516	590	674	747	930	1030	1169	1273	1379
57	266	298	322	404	445	488	578	666	713	763	923	1057	1223	1373	1722	1923	2116	2416	2523
	145	162	175	219	240	263	311	354	374	407	489	559	639	708	882	977	1108	1207	1307
58	257	288	312	391	430	473	559	643	688	750	891	1021	1181	1326	1662	1857	2043	2337	2436
	138	154	167	208	228	251	295	336	355	393	464	531	606	672	837	927	1051	1145	1240
59	249	279	302	379	416	458	541	621	665	725	861	986	1141	1281	1606	1794	1974	2262	2354
	131	146	159	198	217	239	281	319	337	374	440	504	576	638	794	880	999	1088	1178
60	242	271	293	367	402	443	524	600	643	701	833	954	1103	1238	1553	1734	1908	2190	2275
	125	140	151	189	206	227	267	304	321	355	419	479	547	607	755	836	949	1034	1120
61	234	262	284	356	389	429	508	581	622	678	805	922	1067	1198	1502	1678	1846	2122	2201
	119	133	144	180	196	216	255	288	304	338	398	456	521	577	718	796	903	984	1065
62	227	254	275	345	376	416	492	562	602	656	779	893	1033	1159	1454	1624	1786	2057	2130
	114	127	137	172	186	206	243	275	290	322	379	434	496	549	684	758	860	937	1014
63	220	247	267	335	364	403	477	544	583	635	755	864	1000	1123	1408	1572	1730	1994	2063
	108	121	131	164	178	196	232	262	276	306	361	413	472	524	652	722	819	892	966
64	214	240	259	325	353	390	463	527	564	616	731	837	969	1088	1364	1523	1676	1934	1998
	104	116	125	157	169	187	221	249	264	292	344	394	450	499	622	688	781	851	922

DESIGN GRID 2 GIRDERS

32' GIRDER



$w_{1D} = 30'(20\ PSF) = 600\ PLF$

$w_{1S} = 30'(36\ PSF) + \frac{25\ PSF(9')3'}{2(33')} + \frac{27\ PSF(8')3'}{2(26')} = 1103\ PLF$

$w_{2S} = 17'(29\ PSF) = 493\ PLF$

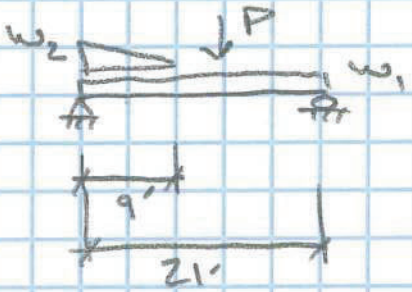
$P_D = 3k$

$w_{1W} = 30'(-32\ PSF) = -960\ PLF$

USE W21x44 MIN

CC = 0.95 < 1, OK

21' GIRDER - NOT USED



$w_{1D} = 35'(20\ PSF) = 700\ PLF$

$w_{1S} = 35'(36\ PSF) + \frac{25\ PSF(9')3'}{2(33')} + \frac{29\ PSF(9')3'}{2(37')} = 1285\ PLF$

$w_{2S} = 493\ PLF$

$P_D = 3k$

$w_{1W} = 35'(-32\ PSF) = -1120\ PLF$

USE W16x31 MIN

CC = 0.92 < 1, OK.

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: 32' Girder on Grid 2 - Downward Load

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

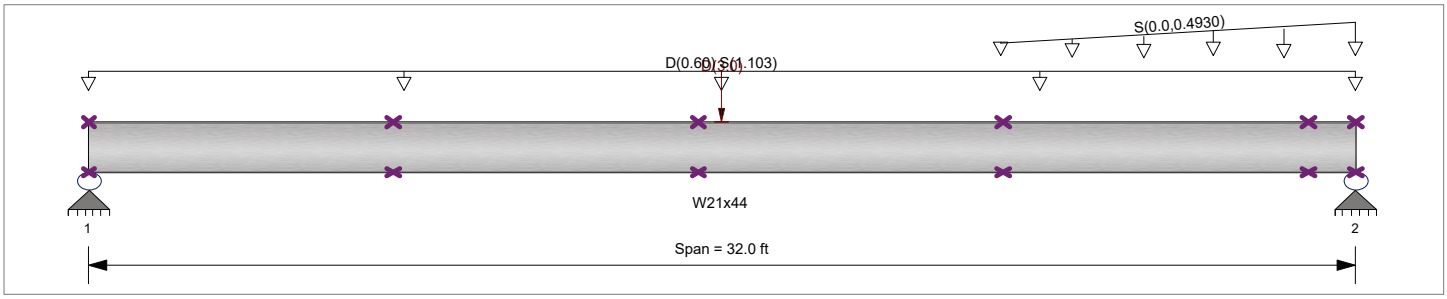
Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam bracing is defined as a set spacing over all spans
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi

Unbraced Lengths

First Brace starts at 7.70 ft from Left-Most support
Regular spacing of lateral supports on length of beam = 7.70 ft



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.60, S = 1.103 k/ft, Tributary Width = 1.0 ft
Varying Uniform Load : S= 0.0->0.4930 k/ft, Extent = 23.0 -->> 32.0 ft, Trib Width = 1.0 ft
Point Load : D = 3.0 k @ 16.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.949 : 1	Maximum Shear Stress Ratio =	0.172 : 1
Section used for this span	W21x44	Section used for this span	W21x44
Ma : Applied	201.958 k-ft	Va : Applied	24.861 k
Mn / Omega : Allowable	212.789 k-ft	Vn/Omega : Allowable	144.90 k
Load Combination	+D+0.70S	Load Combination	+D+0.70S
		Location of maximum on span	32.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.768 in	Ratio =	499	>=360	Span: 1 : +0.70S
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	1.496 in	Ratio =	257	>=240.	Span: 1 : +D+0.70S
Max Upward Total Deflection	0 in	Ratio =	0	<240.0	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega	
D Only													
Dsgn. L = 7.68 ft	1	0.284	0.077	67.55		67.55	397.50	238.02	1.55	1.00	11.10	217.35	144.90
Dsgn. L = 7.68 ft	1	0.445	0.045	99.72	67.55	99.72	374.23	224.09	1.11	1.00	6.49	217.35	144.90
Dsgn. L = 7.68 ft	1	0.465	0.040	100.80	75.37	100.80	361.74	216.61	1.07	1.00	5.72	217.35	144.90
Dsgn. L = 7.68 ft	1	0.317	0.071	75.37	13.72	75.37	397.50	238.02	1.40	1.00	10.33	217.35	144.90
Dsgn. L = 1.28 ft	1	0.058	0.077	13.72		13.72	397.50	238.02	1.60	1.00	11.10	217.35	144.90
+D+0.70S													
Dsgn. L = 7.68 ft	1	0.591	0.163	140.78		140.78	397.50	238.02	1.54	1.00	23.60	217.35	144.90
Dsgn. L = 7.68 ft	1	0.909	0.090	200.62	140.78	200.62	368.57	220.70	1.09	1.00	13.06	217.35	144.90
Dsgn. L = 7.68 ft	1	0.949	0.076	201.96	158.42	201.96	355.36	212.79	1.05	1.00	11.01	217.35	144.90
Dsgn. L = 7.68 ft	1	0.666	0.157	158.42	30.43	158.42	397.50	238.02	1.38	1.00	22.69	217.35	144.90
Dsgn. L = 1.28 ft	1	0.128	0.172	30.43		30.43	397.50	238.02	1.60	1.00	24.86	217.35	144.90
+D+0.5250S													
Dsgn. L = 7.68 ft	1	0.515	0.141	122.47		122.47	397.50	238.02	1.54	1.00	20.47	217.35	144.90
Dsgn. L = 7.68 ft	1	0.793	0.079	175.40	122.47	175.40	369.37	221.18	1.10	1.00	11.42	217.35	144.90
Dsgn. L = 7.68 ft	1	0.828	0.067	176.67	137.66	176.67	356.25	213.33	1.06	1.00	9.69	217.35	144.90

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: 32' Girder on Grid 2 - Downward Load

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
Dsgn. L = 7.68 ft	1	0.578	0.135	137.66	26.25	137.66	397.50	238.02	1.38	1.00	19.60	217.35	144.90
Dsgn. L = 1.28 ft	1	0.110	0.148	26.25		26.25	397.50	238.02	1.60	1.00	21.42	217.35	144.90
+0.60D													
Dsgn. L = 7.68 ft	1	0.170	0.046	40.53		40.53	397.50	238.02	1.55	1.00	6.66	217.35	144.90
Dsgn. L = 7.68 ft	1	0.267	0.027	59.83	40.53	59.83	374.23	224.09	1.11	1.00	3.90	217.35	144.90
Dsgn. L = 7.68 ft	1	0.279	0.024	60.48	45.22	60.48	361.74	216.61	1.07	1.00	3.43	217.35	144.90
Dsgn. L = 7.68 ft	1	0.190	0.043	45.22	8.23	45.22	397.50	238.02	1.40	1.00	6.20	217.35	144.90
Dsgn. L = 1.28 ft	1	0.035	0.046	8.23		8.23	397.50	238.02	1.60	1.00	6.66	217.35	144.90
+D+0.10S													
Dsgn. L = 7.68 ft	1	0.328	0.089	78.01		78.01	397.50	238.02	1.55	1.00	12.89	217.35	144.90
Dsgn. L = 7.68 ft	1	0.511	0.051	114.13	78.01	114.13	372.79	223.23	1.11	1.00	7.43	217.35	144.90
Dsgn. L = 7.68 ft	1	0.534	0.045	115.25	87.24	115.25	360.12	215.64	1.07	1.00	6.48	217.35	144.90
Dsgn. L = 7.68 ft	1	0.367	0.083	87.24	16.10	87.24	397.50	238.02	1.40	1.00	12.10	217.35	144.90
Dsgn. L = 1.28 ft	1	0.068	0.090	16.10		16.10	397.50	238.02	1.60	1.00	13.07	217.35	144.90

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+0.70S	1.4961	16.091		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	23.599	24.861
Max Upward from Load Combinations	23.599	24.861
Max Upward from Load Cases	17.856	19.659
D Only	11.100	11.100
+D+0.70S	23.599	24.861
+D+0.5250S	20.474	21.421
+0.60D	6.660	6.660
+D+0.10S	12.886	13.066
S Only	17.856	19.659

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Girder on Grid 2 - Uplift Case Load

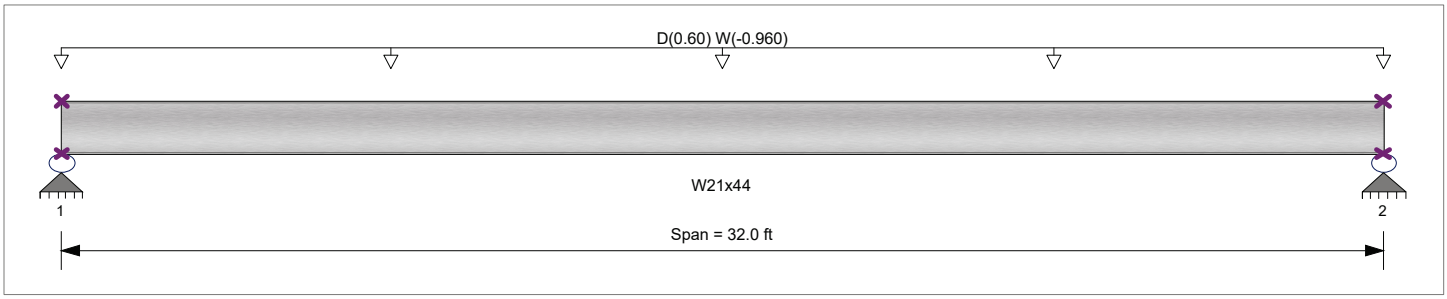
Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.60, W = -0.960 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.683 : 1	Maximum Shear Stress Ratio =	0.024 : 1
Section used for this span	W21x44	Section used for this span	W21x44
Ma : Applied	27.648 k-ft	Va : Applied	3.456 k
Mn / Omega : Allowable	40.453 k-ft	Vn/Omega : Allowable	144.90 k
Load Combination	+0.60D+0.60W	Load Combination	+0.60D+0.60W
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Upward Transient Deflection	-0.558 in	Ratio =	687 >=360	Span: 1 : +0.60W
Max Downward Total Deflection	0 in	Ratio =	0 <240.0	n/a
Max Upward Total Deflection	0 in	Ratio =	0 <240.0	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
+0.60D+0.60W											
Dsgn. L = 32.00 ft	1	0.683	0.024		-27.65	27.65	67.56	40.45	1.14 1.00	3.46	217.35 144.90

Overall Maximum Deflections

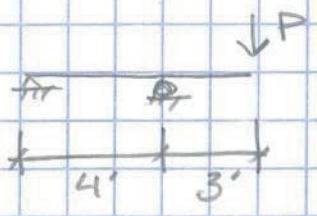
Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1		0.0000	0.000	+0.60W	-0.5584	16.091

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Downward from all Load Conditions (Resisting Uplift)	-3.456	-3.456
Max Downward from Load Combinations (Resisting Uplift)	-3.456	-3.456
+0.60D+0.60W	-3.456	-3.456

DESIGN CHANNEL OUT RIGGER AT ENTRY



$P_D = 6'(4'(20\ PSF + 5'(10\ PSF)) = 780\#$

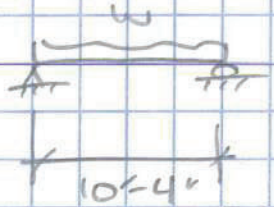
$P_S = 6'(4'(73\ PSF)) = \underline{1752\#}$

USE C6x8.2 MIN

CC = 0.65 < 1, OK

-SEE ATTACHED

DESIGN ENTRY BEAMS



$w_D = 8'(20\ PSF) = 160\ PLF$

$w_S = 8'(73\ PSF) = 584\ PLF$

USE W6x9 MIN

CC = 0.49 < 1, OK

-SEE ATTACHED

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: ENTRY OUTRIGGER

Code References

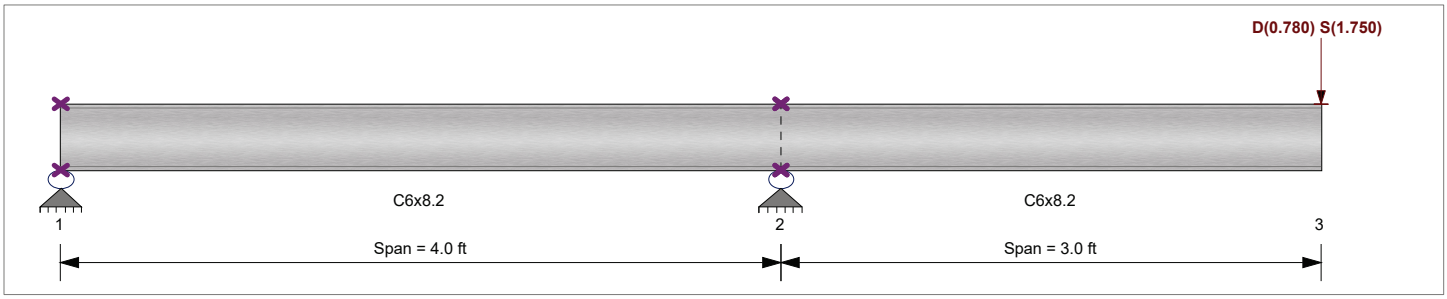
Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 36.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load(s) for Span Number 2
Point Load : D = 0.780, S = 1.750 k @ 3.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.649 : 1	Maximum Shear Stress Ratio =	0.129 : 1
Section used for this span	C6x8.2	Section used for this span	C6x8.2
Ma : Applied	6.015 k-ft	Va : Applied	2.005 k
Mn / Ω : Allowable	9.269 k-ft	Vn / Ω : Allowable	15.521 k
Load Combination	+D+0.70S	Load Combination	+D+0.70S
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 2

Maximum Deflection

Max Downward Transient Deflection	0.167 in	Ratio =	431	>=360	Span: 2 : S Only
Max Upward Transient Deflection	-0.025 in	Ratio =	1,948	>=360	Span: 1 : S Only
Max Downward Total Deflection	0.191 in	Ratio =	376	>=180	Span: 2 : +D+0.70S
Max Upward Total Deflection	-0.028 in	Ratio =	1700	>=180	Span: 1 : +D+0.70S

Maximum Flexural Forces & Stresses for Load Combinations

Load Combination / Segment	UL Length ft	Span #	Cb	Max Flexural Stress Ratio	+ve Moment +ve M SR	Mmax +	Mnx/Ω+	-ve Moment -ve M SR	Mmax -	Mnx/Ω-
D Only										
Design Segment 1 L=4.00	1 4.00	1	1.67	0.252				0.252	-2.34	9.27
Design Segment 2 L=3.00	2 3.00	2	1.00	0.252				0.252	-2.34	9.27
+D+0.70S										
Design Segment 1 L=4.00	1 4.00	1	1.67	0.649				0.649	-6.02	9.27
Design Segment 2 L=3.00	2 3.00	2	1.00	0.649				0.649	-6.02	9.27
+D+0.5250S										
Design Segment 1 L=4.00	1 4.00	1	1.67	0.550				0.550	-5.10	9.27
Design Segment 2 L=3.00	2 3.00	2	1.00	0.550				0.550	-5.10	9.27
+0.60D										
Design Segment 1 L=4.00	1 4.00	1	1.67	0.151				0.151	-1.40	9.27
Design Segment 2 L=3.00	2 3.00	2	1.00	0.151				0.151	-1.40	9.27
+D+0.10S										
Design Segment 1 L=4.00	1 4.00	1	1.67	0.309				0.309	-2.87	9.27
Design Segment 2 L=3.00	2 3.00	2	1.00	0.309				0.309	-2.87	9.27

Maximum Shear Forces & Stresses for Load Combinations

Load Combination	V SR	Vmax	Vnx	Vnx/Ω
D Only				
Design Segment 1 L=4.00	0.038	0.59	25.92	15.52
Design Segment 2 L=3.00	0.050	0.78	25.92	15.52

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: ENTRY OUTRIGGER

Maximum Shear Forces & Stresses for Load Combinations

Load Combination	V SR	Vmax	Vnx	Vnx/Ω
+D+0.70S				
Design Segment 1 L=4.00	0.097	1.50	25.92	15.52
Design Segment 2 L=3.00	0.129	2.01	25.92	15.52
+D+0.5250S				
Design Segment 1 L=4.00	0.082	1.27	25.92	15.52
Design Segment 2 L=3.00	0.109	1.70	25.92	15.52
+0.60D				
Design Segment 1 L=4.00	0.023	0.35	25.92	15.52
Design Segment 2 L=3.00	0.030	0.47	25.92	15.52
+D+0.10S				
Design Segment 1 L=4.00	0.046	0.72	25.92	15.52
Design Segment 2 L=3.00	0.062	0.96	25.92	15.52

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1		0.0000	0.000	+D+0.70S	-0.0282	2.320
2	+D+0.70S	0.1913	3.000		0.0000	2.320

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Cases & Combinations		3.509	
Max Upward from Load Combinations		3.509	
Max Upward from Load Cases		3.063	
Max Downward from all Load Cases & Combinations (Resisting Uplift)	-1.504		
Max Downward from Load Combinations (Resisting Uplift)	-1.504		
Max Downward from Load Cases (Resisting Uplift)	-1.313		
D Only	-0.585	1.365	
+D+0.70S	-1.504	3.509	
+D+0.5250S	-1.274	2.973	
+0.60D	-0.351	0.819	
+D+0.10S	-0.716	1.671	
S Only	-1.313	3.063	

Vertical Reactions for Load Cases

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from Load Cases		3.063	
Max Downward from Load Cases (Resisting Uplift)	-1.313		
D Only	-0.585	1.365	
S Only	-1.313	3.063	

Vertical Reactions for Load Combinations

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from Load Combinations		3.509	
Max Downward from Load Combinations (Resisting Uplift)	-1.504		
+D+0.70S	-1.504	3.509	
+D+0.5250S	-1.274	2.973	
+0.60D	-0.351	0.819	
+D+0.10S	-0.716	1.671	

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Entry Beam

Code References

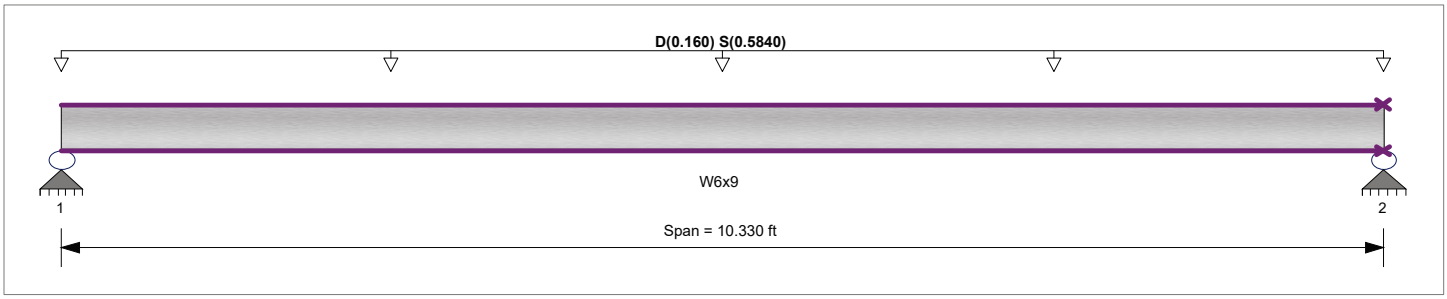
Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.160, S = 0.5840 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.488 : 1	Maximum Shear Stress Ratio =	0.146 : 1
Section used for this span	W6x9	Section used for this span	W6x9
Ma : Applied	7.587 k-ft	Va : Applied	2.938 k
Mn / Ω : Allowable	15.540 k-ft	Vn / Ω : Allowable	20.060 k
Load Combination	+D+0.70S	Load Combination	+D+0.70S
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.316 in	Ratio =	392	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.308 in	Ratio =	403	>=240.	Span: 1 : +D+0.70S
Max Upward Total Deflection	0 in	Ratio =	0	<240.0	n/a

Maximum Flexural Forces & Stresses for Load Combinations

Load Combination / Segment	Unbraced Length UL Length ft	Span #	Cb	Max Flexural Stress Ratio	+ve Moment +ve M SR	Mmax +	Mnx/Ω+	-ve Moment -ve M SR	Mmax -	Mnx/Ω-
D Only										
Design Segment 1 L=10.33	10.33	1	1.00	0.137	0.137	2.13	15.54			
+D+0.70S										
Design Segment 1 L=10.33	10.33	1	1.00	0.488	0.488	7.59	15.54			
+D+0.5250S										
Design Segment 1 L=10.33	10.33	1	1.00	0.401	0.401	6.22	15.54			
+0.60D										
Design Segment 1 L=10.33	10.33	1	1.00	0.082	0.082	1.28	15.54			
+D+0.10S										
Design Segment 1 L=10.33	10.33	1	1.00	0.187	0.187	2.91	15.54			

Maximum Shear Forces & Stresses for Load Combinations

Load Combination	V SR	Vmax	Vnx	Vnx/Ω
D Only				
Design Segment 1 L=10.33	0.041	0.83	30.09	20.06
+D+0.70S				
Design Segment 1 L=10.33	0.146	2.94	30.09	20.06
+D+0.5250S				
Design Segment 1 L=10.33	0.120	2.41	30.09	20.06
+0.60D				
Design Segment 1 L=10.33	0.025	0.50	30.09	20.06
+D+0.10S				

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Entry Beam

Maximum Shear Forces & Stresses for Load Combinations

Load Combination	V SR	Vmax	Vnx	Vnx/Ω
Design Segment 1 L=10.33	0.056	1.13	30.09	20.06

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	S Only	0.3160	5.195		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Cases & Combinations	3.016	3.016
Max Upward from Load Combinations	2.938	2.938
Max Upward from Load Cases	3.016	3.016
D Only	0.826	0.826
+D+0.70S	2.938	2.938
+D+0.5250S	2.410	2.410
+0.60D	0.496	0.496
+D+0.10S	1.128	1.128
S Only	3.016	3.016

Vertical Reactions for Load Cases

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from Load Cases	3.016	3.016
D Only	0.826	0.826
S Only	3.016	3.016

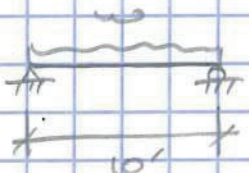
Vertical Reactions for Load Combinations

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from Load Combinations	2.938	2.938
+D+0.70S	2.938	2.938
+D+0.5250S	2.410	2.410
+0.60D	0.496	0.496
+D+0.10S	1.128	1.128

DESIGN SUPPORT FOR SUSPENDED SOFFIT

- JOIST BEAMS



$w_D = 2.5'(10\ PSF) = 250\ PLF$

$M_{max} = wl^2/8 = 3125\ \#\text{-ft}$

$Z_{req} = \frac{\Omega M_{max}}{F_y} = 1.25\ in^3$

$F_y = 50\ ksi,\ \Omega = 1.67$

For $\Delta < \frac{L}{240}$, $I_{req} = \frac{240(5)wl^3}{384E}$

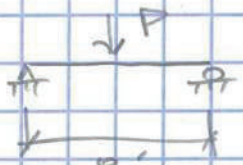
$= 3.9\ in^4$

USE HSS $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{3}{16}$ MIN

$I_x = 4.05\ in^4 > I_{req}$, OK

$Z = 2.76\ in^3 > Z_{req}$, OK

- CROSS BEAMS



$P_D = 10'(250\ PLF) = 2.5k$

$M_{max} = \frac{PL}{4} = 5\ k\text{-ft}$

$Z_{req} = \frac{\Omega M_{max}}{F_y} = 2\ in^3$

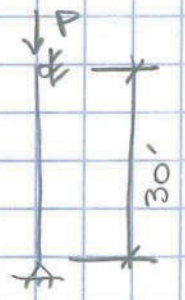
For $\Delta < \frac{L}{240}$, $I_{req} = \frac{240Pl^2}{48E} = 3.97\ in^4$

USE HSS $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{3}{16}$ MIN

$I_x = 4.05\ in^4 > I_{req}$, OK.

$Z = 2.76\ in^3 > Z_{req}$, OK

DESIGN COLUMN ON GRID 2



$P_D = 2(11.1k) + 5k = 27.2k$

$P_S = 2(17.9k) = 35.8k$

$\Sigma P_{D+P_{0.75}} = 52.3k$

USE HSS 7x7x1/4 MIN

$P_n/\Omega_c = 54.1k > \Sigma P$, OK

FOOTINGS

$A_{req} = \frac{\Sigma P}{3.5 ksf} = 13.6 sf$

USE 4' SQ FTGS MIN

$A = 16 sf > A_{req}$

ALT: ROUND HSS 7.500x0.375

$P_n/\Omega_c = 58.2k > \Sigma P$, OK.

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Base Plate

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: HSS7.5X0.375 Baseplate

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC Design Guide # 1, AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024 Rho (or Omega) = 1.00

General Information

Material Properties

AISC Design Method	Allowable Strength Design				
Steel Plate Fy	=	36 ksi			
Concrete Support f'c	=	3 ksi	Ω c	: ASD Safety Factor	2.5
Assumed Bearing Area :	Full Bearing				

Column & Plate

Column Properties

Steel Section	HSS7.500x0.375		
Depth	7.5 in	Area	7.84 in^2
Width	7.5 in	Ixx	50.2 in^4
Flange Thickness	0.349 in	Iyy	50.2 in^4
Web Thickness	0 in		

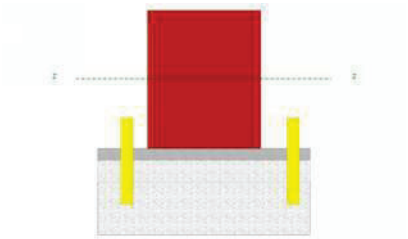
Plate Dimensions

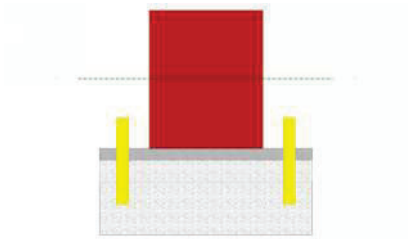
N : Length	14.0 in
B : Width	14.0 in
Thickness	0.750 in

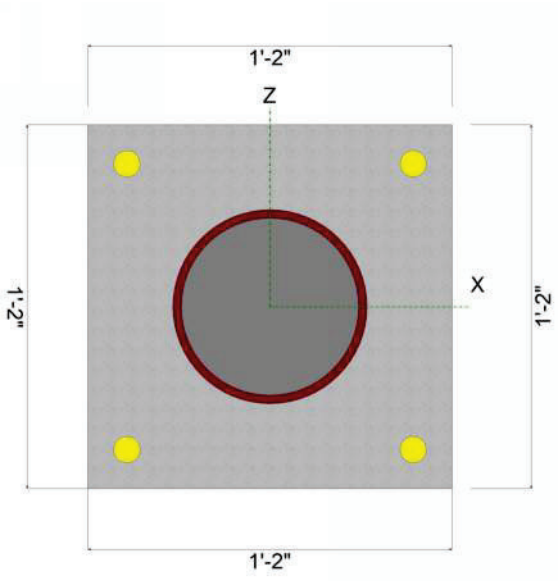
Support Dimensions

Width along "X"	14.0 in
Length along "Z'	14.0 in

Column assumed welded to base plate



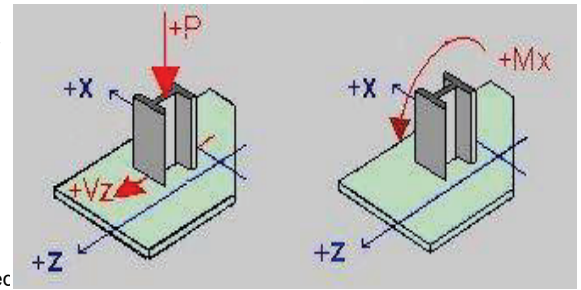




Applied Loads

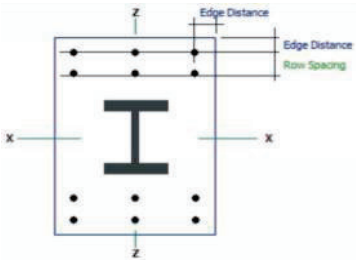
	P-Y	V-Z	M-X
D : Dead Load	27.20 k	k	k-ft
L : Live	k	k	k-ft
Lr : Roof Live	k	k	k-ft
S : Snow	35.80 k	k	k-ft
W : Wind	k	k	k-ft
E : Earthquake	k	k	k-ft
H : Lateral Earth	k	k	k-ft

" P " = Gravity load, "+" sign is downward "+" Moments create higher soil pressure at +Z ed
"+" Shears push plate towards +Z edge



Anchor Bolts

Anchor Bolt or Rod Description	3/4"	
Max of Tension or Pullout Capacity.....		k
Shear Capacity.....		k
Edge distance : bolt to plate.....	1.50	in
Number of Bolts in each Row.....	2	
Number of Bolt Rows.....	1	



Project Title:
Engineer:
Project ID:
Project Descr:

Steel Base Plate

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: HSS7.5X0.375 Baseplate

GOVERNING DESIGN LOAD CASE SUMMARY

Plate Design Summary

Design Method	**Allowable Strength Design**
Governing Load Combinat	**+D+0.70S**
Governing Load Case Typ	**Axial Load Only**
Governing STRESS RATI(	**0.7036**
Design Plate Size	**1'-2" x 1'-2" x 0 -3/4"**
Pa : Axial Load	52.26 k
Ma : Moment	0 k-ft
Ma : Max. Moment	2.133 k-in
fb : Max. Bending Stress	15.168 ksi
Fb : Allowable : Fy / Ω	21.557 ksi
Bending Stress Rati	0.704
	Bending Stress OK
fu : Max. Concrete Bearing Stress	0.267 ksi
ΦBn :	1.6575 ksi
Bearing Stress Ratic	0.261
	Bearing Stress OK

Load Comb. : D Only

Axial Load Only, No Moment

Loading

Pa : Axial Load	27.200	k
Design Plate Height	14.000	in
Design Plate Width	14.000	in
Will be different from entry if partial bearing used.		
A1 : Plate Area	196.000	in^2
A2: Support Area	196.000	in^2
sqrt(A2/A1)	1.000	

Distance for Moment Calculation

" m "	4.000	in
" n "	4.000	in
X	0.000	in^2
Lambda	0.000	
n'	0.000	in
n' * Lambda	0.000	in
L = max(m, n, n")	4.000	in

Bearing Stresses

ΦBn	1.658 ksi
fa : Max. Bearing Pressure	0.139 ksi
Stress Ratio	**0.136**

Plate Bending Stresses

Mmax = Fu * L^2 / 2	1.110 k-in on 1" strip
fb : Actual	7.895 ksi
Fb : Allowable	21.557 ksi
Stress Ratio	**0.366**

Load Comb. : +D+0.70S

Axial Load Only, No Moment

Loading

Pa : Axial Load	52.260	k
Design Plate Height	14.000	in
Design Plate Width	14.000	in
Will be different from entry if partial bearing used.		
A1 : Plate Area	196.000	in^2
A2: Support Area	196.000	in^2
sqrt(A2/A1)	1.000	

Distance for Moment Calculation

" m "	4.000	in
" n "	4.000	in
X	0.000	in^2
Lambda	0.000	
n'	0.000	in
n' * Lambda	0.000	in
L = max(m, n, n")	4.000	in

Bearing Stresses

ΦBn	1.658 ksi
fa : Max. Bearing Pressure	0.267 ksi
Stress Ratio	**0.261**

Plate Bending Stresses

Mmax = Fu * L^2 / 2	2.133 k-in on 1" strip
fb : Actual	15.168 ksi
Fb : Allowable	21.557 ksi
Stress Ratio	**0.704**

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Base Plate

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DESCRIPTION: HSS7.5X0.375 Baseplate

Load Comb. : +D+0.5250S

Axial Load Only, No Moment

Loading		
Pa : Axial Load	45.995	k
Design Plate Height	14.000	in
Design Plate Width	14.000	in
Will be different from entry if partial bearing used.		
A1 : Plate Area	196.000	in^2
A2: Support Area	196.000	in^2
sqrt(A2/A1)	1.000	

Distance for Moment Calculation		
" m "	4.000	in
" n "	4.000	in
X	0.000	in^2
Lambda	0.000	
n'	0.000	in
n' * Lambda	0.000	in
L = max(m, n, n")	4.000	in

Bearing Stresses	
ΦBn	1.658 ksi
fa : Max. Bearing Pressure	0.235 ksi
Stress Ratio	**0.230**

Plate Bending Stresses	
Mmax = Fu * L^2 / 2	1.877 k-in on 1" strip
fb : Actual	13.350 ksi
Fb : Allowable	21.557 ksi
Stress Ratio	**0.619**

Load Comb. : +0.60D

Axial Load Only, No Moment

Loading		
Pa : Axial Load	16.320	k
Design Plate Height	14.000	in
Design Plate Width	14.000	in
Will be different from entry if partial bearing used.		
A1 : Plate Area	196.000	in^2
A2: Support Area	196.000	in^2
sqrt(A2/A1)	1.000	

Distance for Moment Calculation		
" m "	4.000	in
" n "	4.000	in
X	0.000	in^2
Lambda	0.000	
n'	0.000	in
n' * Lambda	0.000	in
L = max(m, n, n")	4.000	in

Bearing Stresses	
ΦBn	1.658 ksi
fa : Max. Bearing Pressure	0.083 ksi
Stress Ratio	**0.082**

Plate Bending Stresses	
Mmax = Fu * L^2 / 2	0.666 k-in on 1" strip
fb : Actual	4.737 ksi
Fb : Allowable	21.557 ksi
Stress Ratio	**0.220**

Load Comb. : +D+0.10S

Axial Load Only, No Moment

Loading		
Pa : Axial Load	30.780	k
Design Plate Height	14.000	in
Design Plate Width	14.000	in
Will be different from entry if partial bearing used.		
A1 : Plate Area	196.000	in^2
A2: Support Area	196.000	in^2
sqrt(A2/A1)	1.000	

Distance for Moment Calculation		
" m "	4.000	in
" n "	4.000	in
X	0.000	in^2
Lambda	0.000	
n'	0.000	in
n' * Lambda	0.000	in
L = max(m, n, n")	4.000	in

Bearing Stresses	
ΦBn	1.658 ksi
fa : Max. Bearing Pressure	0.157 ksi
Stress Ratio	**0.154**

Plate Bending Stresses	
Mmax = Fu * L^2 / 2	1.256 k-in on 1" strip
fb : Actual	8.934 ksi
Fb : Allowable	21.557 ksi
Stress Ratio	**0.414**

Project Title:
Engineer:
Project ID:
Project Descr:

General Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: F4.12 FOOTING

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	
Min. Overturning Safety Factor	=	1.50 : 1
Min. Sliding Safety Factor	=	1.50 : 1
Add Ftg Wt for Soil Pressure	:	No
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	3.50	ksf
Soil Density	=	110.0	pcf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=	3.0	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=		ksf
when max. length or width is greater than	=		ft

Dimensions

Width parallel to X-X Axis	=	4.0	ft
Length parallel to Z-Z Axis	=	4.0	ft
Footing Thickness	=	12.0	in

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a

Pedestal dimensions...

px : parallel to X-X Axis	=	14.0	in
pz : parallel to Z-Z Axis	=	14.0	in
Height	=		in

Bottom Reinforcing

Bars parallel to X-X Axis (resisting Z Flexure)			
Number of Bars	=		5
Reinforcing Bar Size	=	#	5
Bars parallel to Z-Z Axis (resisting X Flexure)			
Number of Bars	=		5
Reinforcing Bar Size	=	#	5

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.750	in

Applied Loads

		D	Lr	L	S	W	E	H	
P : Vertical Load	=	27.200	0.000	0.000	35.800	0.000	0.000	0.000	k
OB : Overburden	=	0.000	0.000	0.000	0.000	0.000	0.000	0.000	ksf
M-xx	=	0.000	0.000	0.000	0.000	0.000	0.000	0.000	k-ft
M-zz	=	0.000	0.000	0.000	0.000	0.000	0.000	0.000	k-ft
V-x	=	0.000	0.000	0.000	0.000	0.000	0.000	0.000	k
V-z	=	0.000	0.000	0.000	0.000	0.000	0.000	0.000	k

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Project ID:
Project Descr:

General Footing

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LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: F4.12 FOOTING

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9909	Soil Bearing	3.468 ksf	3.50 ksf	+D+0.70S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	999.0	Sliding - X-X	0.0 k	12.322 k	D Only
PASS	999.0	Sliding - Z-Z	0.0 k	12.322 k	D Only
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.3111	Z Flexure (+X) Bot Tens	4.269 k-ft/ft	13.723 k-ft/ft	+1.20D+S
PASS	0.3111	Z Flexure (-X) Bot Tens	4.269 k-ft/ft	13.723 k-ft/ft	+1.20D+S
PASS	0.669	Min Steel X Flexure Bottom	0.259 in2/ft	0.388 in2/ft	n/a
PASS	0.3111	X Flexure (+Z) Bot Tens	4.269 k-ft/ft	13.723 k-ft/ft	+1.20D+S
PASS	0.3111	X Flexure (-Z) Bot Tens	4.269 k-ft/ft	13.723 k-ft/ft	+1.20D+S
PASS	0.669	Min Steel Z Flexure Bottom	0.259 in2/ft	0.388 in2/ft	n/a
PASS	0.0	Z Flexure (+X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	Z Flexure (-X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel X Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.0	X Flexure (+Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	X Flexure (-Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel Z Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.5975	1-way Shear (+X)	30.946 psi	51.791 psi	+1.20D+S
PASS	0.5975	1-way Shear (-X)	30.946 psi	51.791 psi	+1.20D+S
PASS	0.5975	1-way Shear (+Z)	30.946 psi	51.791 psi	+1.20D+S
PASS	0.5975	1-way Shear (-Z)	30.946 psi	51.791 psi	+1.20D+S
PASS	0.4449	2-way Punching	73.102 psi	164.317 psi	+1.20D+S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	3.50	n/a	0.0	1.901	1.901	n/a	n/a	0.543
X-X, +D+0.70S	3.50	n/a	0.0	3.468	3.468	n/a	n/a	0.991
X-X, +D+0.5250S	3.50	n/a	0.0	3.076	3.076	n/a	n/a	0.879
X-X, +0.60D	3.50	n/a	0.0	1.141	1.141	n/a	n/a	0.326
X-X, +D+0.10S	3.50	n/a	0.0	2.125	2.125	n/a	n/a	0.607
Z-Z, D Only	3.50	0.0	n/a	n/a	n/a	1.901	1.901	0.543
Z-Z, +D+0.70S	3.50	0.0	n/a	n/a	n/a	3.468	3.468	0.991
Z-Z, +D+0.5250S	3.50	0.0	n/a	n/a	n/a	3.076	3.076	0.879
Z-Z, +0.60D	3.50	0.0	n/a	n/a	n/a	1.141	1.141	0.326
Z-Z, +D+0.10S	3.50	0.0	n/a	n/a	n/a	2.125	2.125	0.607

Overturning Stability

Rotation Axis & Load Combination...	Moment Sum About Negative Edge (k-ft) Overturning	Resisting	Ratio	Status	Moment Sum About Positive Edge (k-ft) Overturning	Resisting	Ratio	Status
Footing Has NO Overturning								

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	2.362	+Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +1.40D	2.362	-Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +1.20D	2.024	+Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +1.20D	2.024	-Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +1.20D+0.30S	2.698	+Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +1.20D+0.30S	2.698	-Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +1.20D+S	4.269	+Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +1.20D+S	4.269	-Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +0.90D	1.518	+Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK

Project Title:
Engineer:
Project ID:
Project Descr:

General Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: F4.12 FOOTING

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +0.90D	1.518	-Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +1.20D+0.150S	2.361	+Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
X-X, +1.20D+0.150S	2.361	-Z	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.40D	2.362	-X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.40D	2.362	+X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.20D	2.024	-X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.20D	2.024	+X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.20D+0.30S	2.698	-X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.20D+0.30S	2.698	+X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.20D+S	4.269	-X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.20D+S	4.269	+X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +0.90D	1.518	-X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +0.90D	1.518	+X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.20D+0.150S	2.361	-X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK
Z-Z, +1.20D+0.150S	2.361	+X	Bottom	0.2592	ACI 7.6.1.1	0.3875	13.723	OK

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	17.12 psi	17.12 psi	17.12 psi	51.79 psi	0.33	OK
+1.20D	14.67 psi	14.67 psi	14.67 psi	51.79 psi	0.28	OK
+1.20D+0.30S	19.56 psi	19.56 psi	19.56 psi	51.79 psi	0.38	OK
+1.20D+S	30.95 psi	30.95 psi	30.95 psi	51.79 psi	0.60	OK
+0.90D	11.01 psi	11.01 psi	11.01 psi	51.79 psi	0.21	OK
+1.20D+0.150S	17.11 psi	17.11 psi	17.11 psi	51.79 psi	0.33	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	17.12 psi	17.12 psi	17.12 psi	51.79 psi	0.33	OK
+1.20D	14.67 psi	14.67 psi	14.67 psi	51.79 psi	0.28	OK
+1.20D+0.30S	19.56 psi	19.56 psi	19.56 psi	51.79 psi	0.38	OK
+1.20D+S	30.95 psi	30.95 psi	30.95 psi	51.79 psi	0.60	OK
+0.90D	11.01 psi	11.01 psi	11.01 psi	51.79 psi	0.21	OK
+1.20D+0.150S	17.11 psi	17.11 psi	17.11 psi	51.79 psi	0.33	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	40.44 psi	164.32 psi	0.25	OK
+1.20D	34.66 psi	164.32 psi	0.21	OK
+1.20D+0.30S	46.19 psi	164.32 psi	0.28	OK
+1.20D+S	73.10 psi	164.32 psi	0.44	OK
+0.90D	26.00 psi	164.32 psi	0.16	OK
+1.20D+0.150S	40.43 psi	164.32 psi	0.25	OK

Project Title:
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Project ID:
Project Descr:

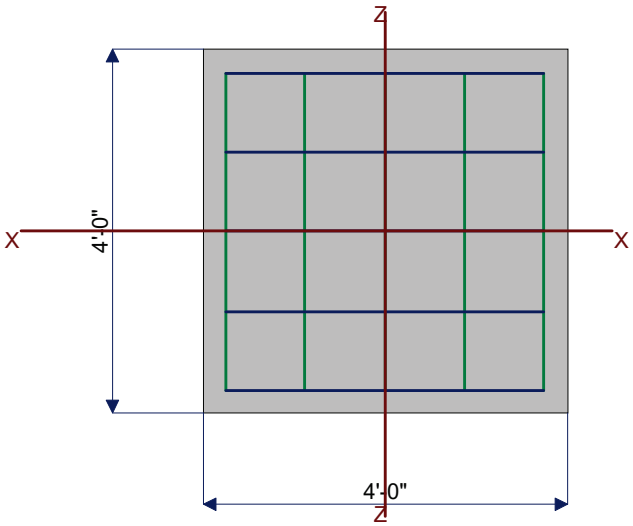
General Footing

Project File: Libby Booth.ec6

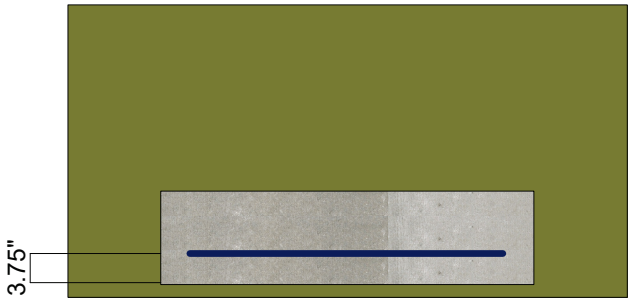
LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: F4.12 FOOTING

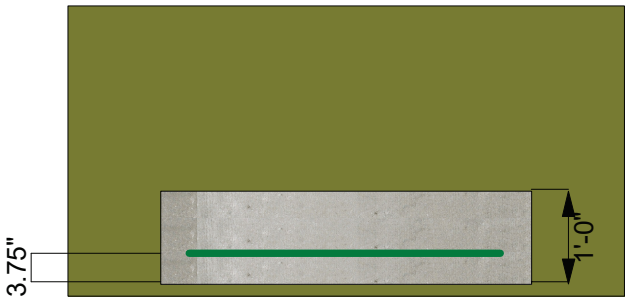
Plan and Section Views



ottom Mat: 5#5 parallel to X-X, 5#5 parallel to Z-



X-X Section Looking to +Z



Z-Z Section Looking to +X

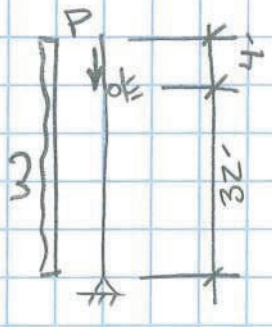
Structural Walls and Their Anchorage Per ASCE 7-22, Section 12.11

For 12" CMU:

Out-of-Plane Forces (Sec. 12.11.1)			
S_{DS} =	*1.34*		
I_e =	*1.25*		
W_p =	*120*	psf	
$F_p = 0.4S_{DS}I_eW_p$ =	**80.4**	psf	Controls
$F_{pmin} = 0.1W_p$ =	12	psf	

Wall Anchorage Forces At The Roof (Sec. 12.11.2)			
Worst Case			
L_f =	*64*	ft	
$k_a = 1.0+L_f/100$	1.64		
$F_p = 0.4S_{DS}k_aI_eW_p$ (psf)	**132**	psf	Controls
$F_{p,min} = Max(5\ psf, 0.2k_aI_eW_p)$	49	psf	

DESIGN WALLS FOR OOP LOAD



$w_w = 48$ PSF

$w_e = 80$ PSF

$P_D = 19'(20\ PSF) = 380$ PLF

$P_b = 19'(36\ PSF) + \frac{29\ PSF(9')}{2} = 815$ PLF

USE SOLID GROUTED 12" CMU ($f'_m = 2.5$ ksi)
W/ #6 VERTS AT 16" O.C. E.F. MIN

$CC = 0.75 < 1$, OK

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: 32' Wall OOP

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

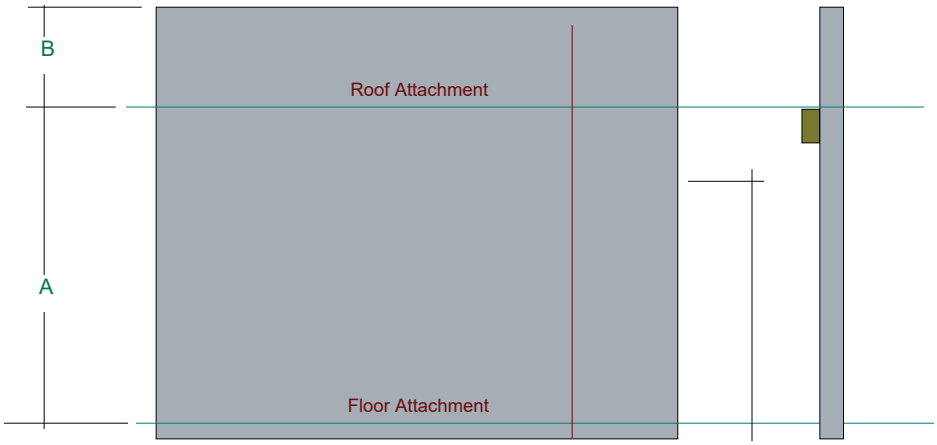
Construction Type : Grouted Hollow Concrete Masonry

F'm	=	2.5 ksi	Nom. Wall Thickness	12	in	Temp Diff across thickness	=	deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	11.625	in	Min Allow Out-of-plane Defl Ra	=	0.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance	9.25	in			
Em = f'm *	=	900.0	Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020
Max % of ρ bal.	=	0.008675	Bar Size	# 6				
Grout Density	=	140 pcf	Bar Spacing	16	in			
Block Weight		Medium Weight						
Wall Weight	=	125.0 psf						
		Wall is Solid Grouted						

One-Story Wall Dimensions

A	Clear Height	=	32 ft
B	Parapet height	=	4 ft

Wall Support Condition Top & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . . (Applied per foot of Strip Width)

			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	8 in	.38			.815	k/ft
Concentric Load							k/ft

Lateral Loads

Wind Loads :
Full area WIND load 48 psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load 80 psf

Fp 1.0 = 80.0 psf

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: 32' Wall OOP

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +1.20D+0.150S+E	Maximum Bending Stress Rat	**0.7492**		
		Max Mu	10.820 k-ft	Phi * Mn	14.442 k-ft
PASS	Service Deflection Check E Only * 0.70	Actual Defl. Ratio L/ Max. Deflection	192 1.997 in	Allowable Defl. Ratio	150.0
PASS	Axial Load Check +1.20D+0.150S+E	Max Pu / Ag Location	26.785 psi 15.467 ft	Max. Allow. Defl. 0.05 * f'm	2.560 in 125.0 psi
PASS	Reinforcing Limit Check	Actual ρ	0.002973	Max Allow ρ	0.007782

Maximum Reactions *for Load Combination...*

Top Horizontal	+D-0.70E	1.154 k
Base Horizontal	+0.60D+0.70E	0.8789 k
Vertical Reaction	+D+0.70S	5.451 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Axial Load 0.05*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	ρ Actual	ρ Max Allow	Bar 'd'
+1.40D at 30.93 to 32.00	1.419	17.445	1.37	0.35	0.90	13.65	0.330	0.0030	0.0086	9.25
+1.20D at 30.93 to 32.00	1.216	17.445	1.37	0.30	0.90	13.58	0.330	0.0030	0.0086	9.25
+1.20D+0.30S at 30.93 to 32.00	1.461	17.445	1.37	0.47	0.90	13.67	0.330	0.0030	0.0086	9.25
+1.20D+0.50W at 14.93 to 16.00	3.616	17.445	1.37	3.29	0.90	14.46	0.330	0.0030	0.0083	9.25
+1.20D-0.50W at 14.93 to 16.00	3.616	17.445	1.37	2.97	0.90	14.46	0.330	0.0030	0.0083	9.25
+1.20D+S at 30.93 to 32.00	2.031	17.445	1.37	0.85	0.90	13.88	0.330	0.0030	0.0085	9.25
+1.20D+S+0.50W at 16.00 to 17.07	4.271	17.445	1.37	3.64	0.90	14.69	0.330	0.0030	0.0082	9.25
+1.20D+S-0.50W at 13.87 to 14.93	4.591	17.445	1.37	2.71	0.90	14.81	0.330	0.0030	0.0081	9.25
+1.20D+W at 14.93 to 16.00	3.616	17.445	1.37	6.51	0.90	14.46	0.330	0.0030	0.0083	9.25
+1.20D-W at 14.93 to 16.00	3.616	17.445	1.37	6.18	0.90	14.46	0.330	0.0030	0.0083	9.25
+1.20D+0.30S+W at 14.93 to 16.00	3.860	17.445	1.37	6.62	0.90	14.54	0.330	0.0030	0.0082	9.25
+1.20D+0.30S-W at 14.93 to 16.00	3.860	17.445	1.37	6.12	0.90	14.54	0.330	0.0030	0.0082	9.25
+0.90D+W at 14.93 to 16.00	2.712	17.445	1.37	6.37	0.90	14.13	0.330	0.0030	0.0084	9.25
+0.90D-W at 14.93 to 16.00	2.712	17.445	1.37	6.13	0.90	14.13	0.330	0.0030	0.0084	9.25
+1.20D+0.150S+E at 14.93 to 16.00	3.738	17.445	1.37	10.85	0.90	14.50	0.330	0.0030	0.0082	9.25
+1.20D+0.150S-E at 14.93 to 16.00	3.738	17.445	1.37	10.44	0.90	14.50	0.330	0.0030	0.0082	9.25
+0.90D+E at 14.93 to 16.00	2.712	17.445	1.37	10.57	0.90	14.13	0.330	0.0030	0.0084	9.25
+0.90D-E at 14.93 to 16.00	2.712	17.445	1.37	10.33	0.90	14.13	0.330	0.0030	0.0084	9.25

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Moment Values Mactual k-ft	Stiffness I gross in^4	Stiffness I cracked in^4	Stiffness I effective in^4	Deflections Deflection in	Deflections Defl. Ratio
D Only at 18.13 to 19.20	2.613	1.37	0.15	1,571.00	281.14	1571.000	0.008	46,759.3
+D+0.70S at 18.13 to 19.20	3.184	1.37	0.37	1,571.00	286.95	1571.000	0.021	18,649.1
+D+0.5250S at 18.13 to 19.20	3.041	1.37	0.32	1,571.00	285.50	1571.000	0.017	21,954.6
+D+0.60W at 16.00 to 17.07	2.880	1.37	3.89	1,571.00	283.86	286.460	0.867	443.0
+D-0.60W at 14.93 to 16.00	3.013	1.37	3.63	1,571.00	285.22	288.510	0.765	502.0
+D+0.450W at 16.00 to 17.07	2.880	1.37	2.93	1,571.00	283.86	290.674	0.559	687.1
+D-0.450W at 14.93 to 16.00	3.013	1.37	2.66	1,571.00	285.22	294.832	0.456	842.4
+D+0.5250S+0.450W at 16.00 to 17.07	3.308	1.37	3.11	1,571.00	288.21	293.794	0.617	622.1
+D+0.5250S-0.450W at 14.93 to 16.00	3.441	1.37	2.53	1,571.00	289.56	301.350	0.399	961.4

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: 32' Wall OOP

+0.60D+0.60W at 14.93 to 16.00	1.808	1.37	3.77	1,571.00	272.87	275.686	0.855	449.0
+0.60D-0.60W at 14.93 to 16.00	1.808	1.37	3.61	1,571.00	272.87	276.111	0.794	483.8
+D+0.70E at 16.00 to 17.07	2.880	1.37	7.52	1,571.00	283.86	284.178	1.970	194.9
+D-0.70E at 14.93 to 16.00	3.013	1.37	7.27	1,571.00	285.22	285.571	1.872	205.1

Design Maximum Combinations - Deflections

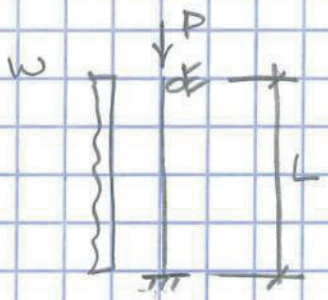
Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
+D+0.10S+0.5250E at 16.00 to 17.07	2.961	1.37	5.69	1,571.00	284.69	285.453	1.420	270.5
+D+0.10S-0.5250E at 14.93 to 16.00	3.095	1.37	5.38	1,571.00	286.05	286.963	1.299	295.6
+0.60D+0.70E at 14.93 to 16.00	1.808	1.37	7.30	1,571.00	272.87	273.204	1.979	194.0
+0.60D-0.70E at 14.93 to 16.00	1.808	1.37	7.14	1,571.00	272.87	273.227	1.920	200.0
+0.420W at 14.93 to 16.00	0.000	1.37	2.50	1,571.00	253.96	265.102	0.451	850.6
-0.420W at 14.93 to 16.00	0.000	1.37	2.50	1,571.00	253.96	265.102	0.451	850.6
E Only * 0.70 at 14.93 to 16.00	0.000	1.37	6.94	1,571.00	253.96	254.338	1.997	192.3
E Only * -0.70 at 14.93 to 16.00	0.000	1.37	6.94	1,571.00	253.96	254.338	1.997	192.3

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.01 k	4.880 k
+D+0.70S	0.0 k	0.02 k	5.450 k
+D+0.5250S	0.0 k	0.02 k	5.308 k
+D+0.60W	0.5 k	0.58 k	4.880 k
+D-0.60W	0.4 k	0.60 k	4.880 k
+D+0.450W	0.3 k	0.43 k	4.880 k
+D-0.450W	0.3 k	0.45 k	4.880 k
+D+0.5250S+0.450W	0.4 k	0.42 k	5.308 k
+D+0.5250S-0.450W	0.3 k	0.46 k	5.308 k
+0.60D+0.60W	0.5 k	0.58 k	2.928 k
+0.60D-0.60W	0.4 k	0.59 k	2.928 k
+D+0.70E	0.9 k	1.14 k	4.880 k
+D-0.70E	0.9 k	1.15 k	4.880 k
+D+0.10S+0.5250E	0.7 k	0.85 k	4.961 k
+D+0.10S-0.5250E	0.6 k	0.87 k	4.961 k
+0.60D+0.70E	0.9 k	1.14 k	2.928 k
+0.60D-0.70E	0.9 k	1.15 k	2.928 k

DESIGN CMU JAMBS FOR OOP LOADS



CASE 1 - (1) 6' WIDE OPNG IN 12" CMU W. WALL

L = 30'
WALL TRIB WIDTH = 5'-0"
ROOF TRIB = 4'
JAMB WIDTH = 24"
P_D = 5'((19')120 PSF + 4'(20 PSF)) = 11.8k
P_S = 5'(4')66 PSF = 1320 #
W_W = 5'(40 PSF) = 200 PLF
W_E = 5'(80 PSF) = 400 PLF

USE (3) #6 E.F. MIN
CC = 0.83 < 1, OK.
-SEE ATTACHED

CASE 2 - 3'-4" WIDE JAMB BTWN (2) 6' WIDE OPNGS IN 12" CMU W. WALL

L = 30'
WALL TRIB = 9'-4"
ROOF TRIB = 4'
JAMB WIDTH = 3'-4"
P_D = 9.3'(19'(120PSF) + 4'(20PSF)) = 21.9k
P_S = 9.3'(4')66 PSF = 2455 #
W_W = 9.3'(39 PSF) = 363 PLF
W_E = 9.3'(80PSF) = 744 PLF

USE (5) #6 E.F. MIN
CC = 0.93 < 1, OK
-SEE ATTACHED

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 1 Jamb

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

Construction Type : Grouted Hollow Concrete Masonry

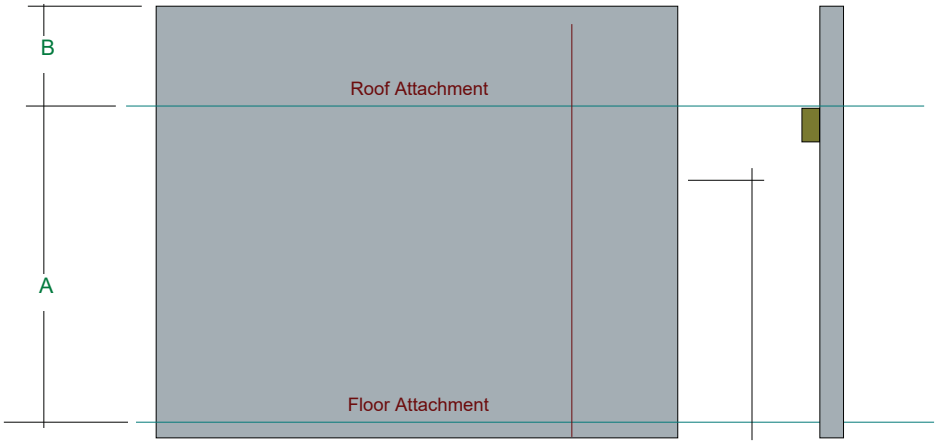
F'm	=	2.5 ksi	Nom. Wall Thickness	12	in	Temp Diff across thickness	=	deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	11.625	in	Min Allow Out-of-plane Defl Ra	=	150.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance	9.25	in			
Em = f'm * 900	=	2,250,000 psi	Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020
n	=	12.89	Bar Size	# 6		Max % of ρ bal.	=	0.008796
Grout Density	=	140 pcf	Bar Spacing	8	in			
Block Weight	Medium Weight							
Wall Weight	=	125.0 psf						

Wall is Solid Grouted

One-Story Wall Dimensions

A Clear Height = 30 ft
B Parapet height = ft

Wall Support Condition Top Pinned, Bottom F



Vertical Loads

Vertical Concentrated Loads . . . (Applied to full "Strip Width")

			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Beam Load #1	Eccentricity	in	11.8			1.32	k
	Dist. from Base	30 ft					

Lateral Loads

Wind Loads :
Wind Load (Full Height) 0 psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load 0 psf

Fp 1.0 = 0.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load				.4	.20 k/ft	30	ft

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 1 Jamb

DESIGN SUMMARY

Results reported for "Strip Width" of 24.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +0.90D+E	Maximum Bending Stress Ratio	**0.8325**		
		Max Mu	-45.978 k-ft	Phi * Mn	55.228 k-ft
PASS	Service Deflection Check +0.70E	Actual Defl. Ratio L/	383	Allowable Defl. Ratio	150.0
		Max. Deflection	0.9409 in	Max. Allow. Defl.	2.40 in
PASS	Axial Load Check +1.20D+0.150S+E	Max Pu / Ag	83.644 psi	Pu Max	23.347k
		Max Pu Location	0.50 ft	Ag	279.120 in2
PASS	Reinforcing Limit Check			0.2 * f'm	500.0 psi
		Actual ρ	0.005946	Max Allow ρ	0.006779

Maximum Reactions *for Load Combination...*

Top Horizontal	E Only	4.506 k
Base Horizontal	E Only	7.494 k
Vertical Reaction	+D+0.70S	20.224 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	ρ Actual	ρ Max Allow	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 1.00	23.159	139.560	2.75	11.19	0.90	56.86	1.320	0.0059	0.0071	9.25
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+S+0.50W at 0.00 to 1.00	24.479	139.560	2.75	11.22	0.90	57.22	1.320	0.0059	0.0070	9.25
+1.20D+W at 0.00 to 1.00	23.157	139.560	2.75	22.99	0.90	56.85	1.320	0.0059	0.0071	9.25
+1.20D+0.30S+W at 0.00 to 1.00	23.553	139.560	2.75	23.01	0.90	56.96	1.320	0.0059	0.0070	9.25
+0.90D+W at 0.00 to 1.00	17.367	139.560	2.75	22.79	0.90	55.23	1.320	0.0059	0.0075	9.25
+1.20D+0.150S+E at 0.00 to 1.00	23.347	139.560	2.75	46.42	0.90	56.91	1.320	0.0059	0.0071	9.25
+0.90D+E at 0.00 to 1.00	17.359	139.560	2.75	45.98	0.90	55.23	1.320	0.0059	0.0075	9.25

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
+0.70E at 17.00 to 18.00	0.000	1.37	8.78	1,571.00	474.55	440.535	0.941	382.6
+0.420W at 17.00 to 18.00	0.000	1.37	2.71	1,571.00	474.55	452.179	0.211	1,706.0

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	19.300 k
+D+0.70S	0.0 k	0.00 k	20.224 k
+D+0.5250S	0.0 k	0.00 k	19.993 k
+D+0.60W	2.2 k	1.36 k	19.300 k
+D+0.450W	1.7 k	1.02 k	19.300 k
+D+0.5250S+0.450W	1.7 k	1.02 k	19.993 k
+0.60D+0.60W	2.2 k	1.36 k	11.580 k
+D+0.70E	5.3 k	3.14 k	19.300 k
+D+0.10S+0.5250E	3.9 k	2.36 k	19.432 k
+0.60D+0.70E	5.3 k	3.15 k	11.580 k
S Only	0.0 k	0.00 k	1.320 k

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 1 Jamb

W Only	3.7 k	2.26 k	0.000 k
E Only	7.5 k	4.51 k	0.000 k

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 2 Jamb

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

Construction Type : Grouted Hollow Concrete Masonry

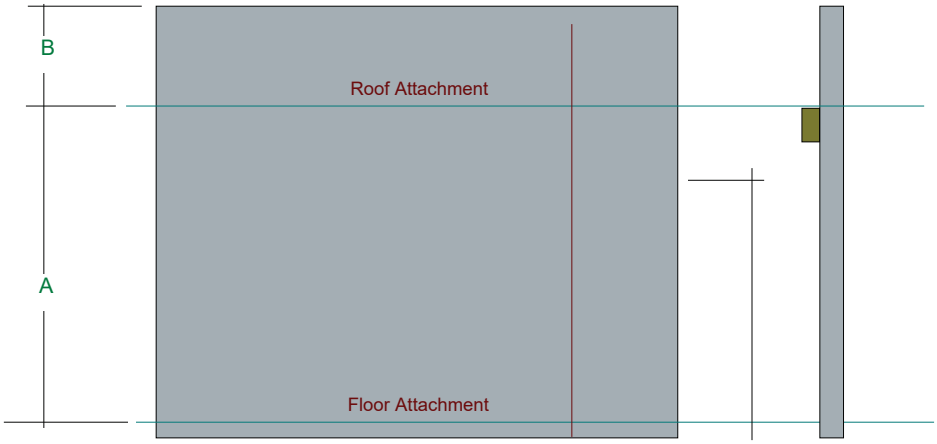
F'm	=	2.50 ksi	Nom. Wall Thickness	12	in	Temp Diff across thickness	=	deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	11.625	in	Min Allow Out-of-plane Defl Ra	=	150.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance	9.250	in			
Em = f'm * 900	=	2,250,000 psi	Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020
n	=	12.89	Bar Size	# 6		Max % of ρ bal.	=	0.008797
Grout Density	=	140 pcf	Bar Spacing	8	in			
Block Weight	Medium Weight							
Wall Weight	=	125.0 psf						

Wall is Solid Grouted

One-Story Wall Dimensions

A Clear Height = 30.0 ft
B Parapet height = ft

Wall Support Condition Top Pinned, Bottom F



Vertical Loads

Vertical Concentrated Loads . . . (Applied to full "Strip Width")			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Beam Load #1	Eccentricity	in	21.9			2.46	k
	Dist. from Base	30.0 ft					

Lateral Loads

Wind Loads :
Wind Load (Full Height) psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load				0.744	0.363 k/ft	30.0	ft

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 2 Jamb

DESIGN SUMMARY

Results reported for "Strip Width" of 40.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Ratio	**0.9263**		
	+0.90D+E	Max Mu	-85.790 k-ft	Phi * Mn	92.617 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	340	Allowable Defl. Ratio	150.0
	+0.70E	Max. Deflection	1.059 in	Max. Allow. Defl.	2.40 in
PASS	Axial Load Check	Max Pu / Ag	89.479 psi	Pu Max	41.626k
	+1.20D+0.150S+E	Max Pu Location	0.50 ft	Ag	465.20 in2
PASS	Reinforcing Limit Check			0.2 * f'm	500.0 psi
		Actual ρ	0.005946	Max Allow ρ	0.006639

Maximum Reactions *for Load Combination...*

Top Horizontal	E Only	8.379 k
Base Horizontal	E Only	13.941 k
Vertical Reaction	+D+0.70S	36.122 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	ρ Actual	ρ Max Allow	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 1.00	41.279	232.600	4.58	20.48	0.90	95.50	2.200	0.0059	0.0069	9.25
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+S+0.50W at 0.00 to 1.00	43.739	232.600	4.58	20.54	0.90	96.17	2.200	0.0059	0.0068	9.25
+1.20D+W at 0.00 to 1.00	41.275	232.600	4.58	41.94	0.90	95.49	2.200	0.0059	0.0069	9.25
+1.20D+0.30S+W at 0.00 to 1.00	42.013	232.600	4.58	41.98	0.90	95.70	2.200	0.0059	0.0069	9.25
+0.90D+W at 0.00 to 1.00	30.955	232.600	4.58	41.53	0.90	92.62	2.200	0.0059	0.0074	9.25
+1.20D+0.150S+E at 0.00 to 1.00	41.626	232.600	4.58	86.69	0.90	95.59	2.200	0.0059	0.0069	9.25
+0.90D+E at 0.00 to 1.00	30.937	232.600	4.58	85.79	0.90	92.62	2.200	0.0059	0.0074	9.25

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
+0.70E at 17.00 to 18.00	0.000	1.37	9.79	1,571.00	474.55	440.461	1.059	340.0
+0.420W at 17.00 to 18.00	0.000	1.37	2.94	1,571.00	474.55	449.194	0.240	1,497.6

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	34.400 k
+D+0.70S	0.0 k	0.00 k	36.122 k
+D+0.5250S	0.0 k	0.00 k	35.692 k
+D+0.60W	4.1 k	2.46 k	34.400 k
+D+0.450W	3.0 k	1.85 k	34.400 k
+D+0.5250S+0.450W	3.1 k	1.85 k	35.691 k
+0.60D+0.60W	4.1 k	2.46 k	20.640 k
+D+0.70E	9.8 k	5.84 k	34.400 k
+D+0.10S+0.5250E	7.3 k	4.39 k	34.646 k
+0.60D+0.70E	9.8 k	5.85 k	20.640 k
S Only	0.0 k	0.00 k	2.460 k

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 2 Jamb

W Only	6.8 k	4.10 k	0.000 k
E Only	13.9 k	8.38 k	0.000 k

CASE 3- JAMB AT 8' WIDE OPNG IN SOUTH WALL

L = 30'
WALL TRIB = 6'
ROOF TRIB = 19'
JAMB WIDTH = 2'

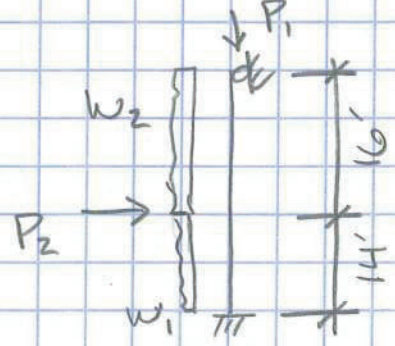
$P_D = 6'(19'(20\ PSF) + 17'(120\ PSF)) = 14.5k$
$P_S = 6'\left((19')36\ PSF + \frac{9'(29\ PSF)}{2}\right) = 4.9\ k$

$w_W = 6'(40\ PSF) = 240\ PLF$
$w_E = 6'(80\ PSF) = 480\ PLF$

USE (3) #6 E.F. MIN
CC = 0.99 < 1, OK
-SEE ATTACHED

CASE 4 JAMB - BETWEEN (2) OPNGS ON GRID 3 BTWN B.3 AND B.6

L = 30'
WALL TRIB = 10' FOR UNIF. LOAD
ROOF TRIB = 19'
JAMB WIDTH = 4'-8"



$P_{1D} = 10'(19'(20\ PSF) + 19'(120\ PSF) = 26.6k$
$P_{1S} = 10'(19'(36PSF) + 8'(27PSF)/2 + 7'(37PSF)/2) = 9.2k$
$w_{2W} = 10'(38PSF) = 380\ PLF$
$w_{2E} = w_{1E} = 10'(80\ PSF) = 800\ PLF$

$P_{2W} = 12'(10')38\ PSF = 4.6k$
$P_{2E} = 10'(0.67)(7'(120PSF) + 12'(20\ PSF)) = 7.2k$

USE (7) #6 E.F. MIN
CC = 1.04, W/IN 5%, SAY OK
- SEE ATTACHED

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 3 Jamb

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

Construction Type : Grouted Hollow Concrete Masonry

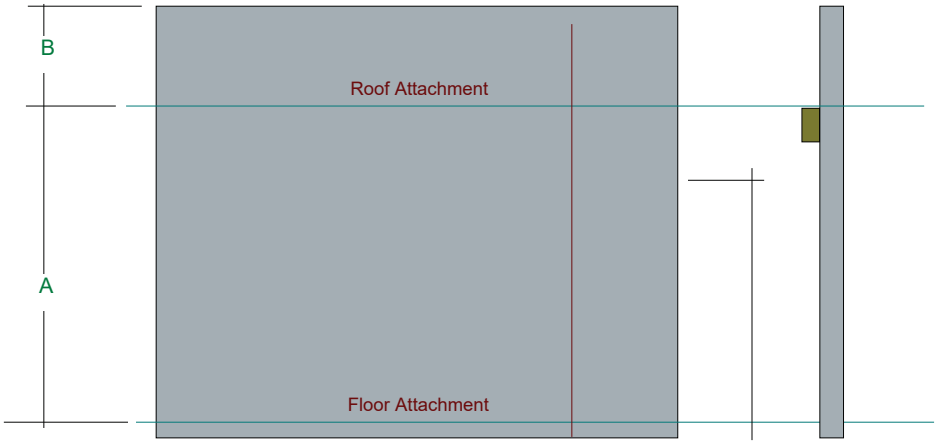
F'm	=	2.50 ksi	Nom. Wall Thickness	12	in	Temp Diff across thickness	=	deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	11.625	in	Min Allow Out-of-plane Defl Ra	=	150.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance	9.250	in			
Em = f'm * 900	=	2,250,000 psi	Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020
n	=	12.89	Bar Size	# 6		Max % of ρ bal.	=	0.008798
Grout Density	=	140 pcf	Bar Spacing	8	in			
Block Weight	Medium Weight							
Wall Weight	=	125.0 psf						

Wall is Solid Grouted

One-Story Wall Dimensions

A Clear Height = 30.0 ft
B Parapet height = ft

Wall Support Condition Top Pinned, Bottom F



Vertical Loads

Vertical Concentrated Loads . . . (Applied to full "Strip Width")			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Beam Load #1	Eccentricity	in	14.5			4.9	k
	Dist. from Base	30.0 ft					

Lateral Loads

Wind Loads :
Wind Load (Full Height) psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load				0.48	0.24 k/ft	30.0	ft

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 3 Jamb

DESIGN SUMMARY

Results reported for "Strip Width" of 24.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Ratio	**0.9927**		
	+0.90D+E	Max Mu	-55.509 k-ft	Phi * Mn	55.915 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	315	Allowable Defl. Ratio	150.0
	+0.70E	Max. Deflection	1.144 in	Max. Allow. Defl.	2.40 in
PASS	Axial Load Check	Max Pu / Ag	97.158 psi	Pu Max	27.119k
	+1.20D+0.150S+E	Max Pu Location	0.50 ft	Ag	279.120 in2
PASS	Reinforcing Limit Check			0.2 * f'm	500.0 psi
		Actual ρ	0.005946	Max Allow ρ	0.006458

Maximum Reactions *for Load Combination...*

Top Horizontal	E Only	5.405 k
Base Horizontal	E Only	8.995 k
Vertical Reaction	+D+0.70S	25.430 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	ρ Actual	ρ Max Allow	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 1.00	26.399	139.560	2.75	13.65	0.90	57.74	1.320	0.0059	0.0068	9.25
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+S+0.50W at 0.00 to 1.00	31.299	139.560	2.75	13.77	0.90	59.05	1.320	0.0059	0.0065	9.25
+1.20D+W at 0.00 to 1.00	26.396	139.560	2.75	27.85	0.90	57.74	1.320	0.0059	0.0068	9.25
+1.20D+0.30S+W at 0.00 to 1.00	27.866	139.560	2.75	27.94	0.90	58.14	1.320	0.0059	0.0067	9.25
+0.90D+W at 0.00 to 1.00	19.796	139.560	2.75	27.56	0.90	55.92	1.320	0.0059	0.0073	9.25
+1.20D+0.150S+E at 0.00 to 1.00	27.119	139.560	2.75	56.20	0.90	57.94	1.320	0.0059	0.0068	9.25
+0.90D+E at 0.00 to 1.00	19.784	139.560	2.75	55.51	0.90	55.92	1.320	0.0059	0.0073	9.25

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
+0.70E at 17.00 to 18.00	0.000	1.37	10.52	1,571.00	474.55	440.424	1.144	314.8
+0.420W at 17.00 to 18.00	0.000	1.37	3.22	1,571.00	474.55	446.740	0.277	1,301.9

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	22.000 k
+D+0.70S	0.0 k	0.00 k	25.430 k
+D+0.5250S	0.0 k	0.00 k	24.573 k
+D+0.60W	2.7 k	1.62 k	22.000 k
+D+0.450W	2.0 k	1.22 k	22.000 k
+D+0.5250S+0.450W	2.0 k	1.22 k	24.573 k
+0.60D+0.60W	2.7 k	1.63 k	13.200 k
+D+0.70E	6.3 k	3.76 k	22.000 k
+D+0.10S+0.5250E	4.7 k	2.83 k	22.490 k
+0.60D+0.70E	6.3 k	3.77 k	13.200 k
S Only	0.0 k	0.00 k	4.900 k

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 3 Jamb

W Only	4.5 k	2.71 k	0.000 k
E Only	9.0 k	5.41 k	0.000 k

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 4 Jamb

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

Construction Type : Grouted Hollow Concrete Masonry

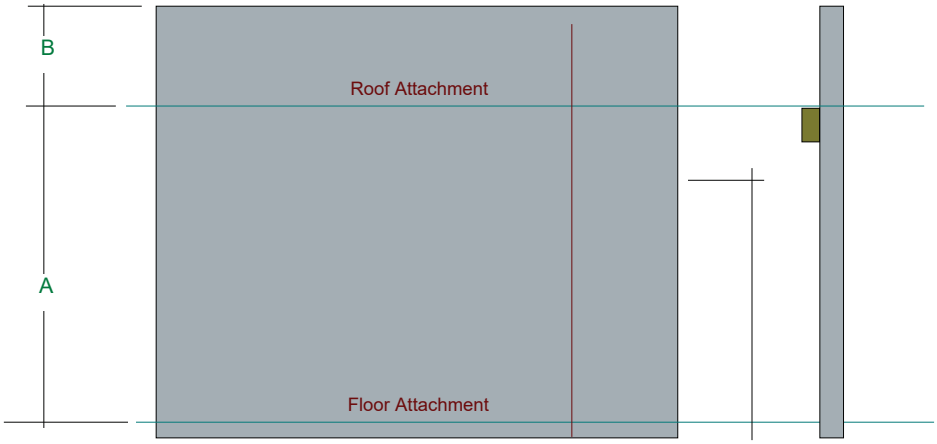
F'm	=	2.50 ksi	Nom. Wall Thickness	12	in	Temp Diff across thickness	=	deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	11.625	in	Min Allow Out-of-plane Defl Ra	=	150.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance	9.250	in			
Em = f'm * 900	=	2,250,000 psi	Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020
n	=	12.89	Bar Size #	6		Max % of ρ bal.	=	0.008797
Grout Density	=	140 pcf	Bar Spacing	8	in			
Block Weight	Medium Weight							
Wall Weight	=	125.0 psf						

Wall is Solid Grouted

One-Story Wall Dimensions

A Clear Height = 30.0 ft
B Parapet height = ft

Wall Support Condition Top Pinned, Bottom F



Vertical Loads

Vertical Concentrated Loads . . . (Applied to full "Strip Width")

			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Beam Load #1	Eccentricity	in	26.60			9.20	k
	Dist. from Base	30.0 ft					

Lateral Loads

Wind Loads :
Wind Load (Full Height) psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

	D	Lr	L	E	W	Height	(Applied to full "STRIP Width")
Point Lateral Load				7.20	4.60 k	14.0 ft	

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load				0.80	k/ft	30.0	ft
Distributed Lateral Load					0.380 k/ft	30.0	14.0 ft

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 4 Jamb

DESIGN SUMMARY

Results reported for "Strip Width" of 56.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
FAIL	Moment Capacity Check +0.90D+E	Maximum Bending Stress Ratio	**1.044**		
		Max Mu	-134.337 k-ft	Phi * Mn	128.623 k-ft
PASS	Service Deflection Check +0.70E	Actual Defl. Ratio L/	295	Allowable Defl. Ratio	150.0
		Max. Deflection	1.219 in	Max. Allow. Defl.	2.40 in
PASS	Axial Load Check +1.20D+0.150S+E	Max Pu / Ag	83.316 psi	Pu Max	54.262k
		Max Pu Location	0.50 ft	Ag	651.28 in2
PASS	Reinforcing Limit Check			0.2 * f'm	500.0 psi
		Actual ρ	0.005946	Max Allow ρ	0.006809

Maximum Reactions *for Load Combination...*

Top Horizontal	E Only	10.996 k
Base Horizontal	E Only	20.204 k
Vertical Reaction	+D+0.70S	50.540 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	ρ Actual	ρ Max Allow	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 1.00	52.919	325.640	6.41	24.01	0.90	132.35	3.080	0.0059	0.0071	9.25
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+S+0.50W at 0.00 to 1.00	62.119	325.640	6.41	24.20	0.90	134.87	3.080	0.0059	0.0068	9.25
+1.20D+W at 0.00 to 1.00	52.916	325.640	6.41	48.67	0.90	132.35	3.080	0.0059	0.0071	9.25
+1.20D+0.30S+W at 0.00 to 1.00	55.676	325.640	6.41	48.80	0.90	133.11	3.080	0.0059	0.0070	9.25
+0.90D+W at 0.00 to 1.00	39.686	325.640	6.41	48.19	0.90	128.63	3.080	0.0059	0.0075	9.25
+1.20D+0.150S+E at 0.00 to 1.00	54.262	325.640	6.41	135.74	0.90	132.72	3.080	0.0059	0.0071	9.25
+0.90D+E at 0.00 to 1.00	39.652	325.640	6.41	134.34	0.90	128.62	3.080	0.0059	0.0075	9.25

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
+0.70E at 16.00 to 17.00	0.000	1.37	11.34	1,571.00	474.55	440.394	1.219	295.4
+0.420W at 17.00 to 18.00	0.000	1.37	3.01	1,571.00	474.55	448.497	0.236	1,526.5

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	44.100 k
+D+0.70S	0.0 k	0.00 k	50.540 k
+D+0.5250S	0.0 k	0.00 k	48.930 k
+D+0.60W	3.4 k	2.79 k	44.100 k
+D+0.450W	2.5 k	2.10 k	44.100 k
+D+0.5250S+0.450W	2.5 k	2.10 k	48.930 k
+0.60D+0.60W	3.4 k	2.80 k	26.460 k
+D+0.70E	14.2 k	7.66 k	44.100 k
+D+0.10S+0.5250E	10.6 k	5.75 k	45.020 k
+0.60D+0.70E	14.2 k	7.68 k	26.460 k
S Only	0.0 k	0.00 k	9.200 k

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

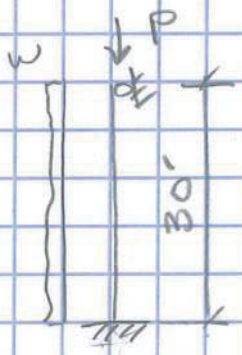
Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Case 4 Jamb

W Only	5.6 k	4.67 k	0.000 k
E Only	20.2 k	11.00 k	0.000 k

DESIGN WALLS UNDER GIRDER SUPPORT



$P_D = 16'(36')20\ PSF = 11.5\ K$

$P_S = 16'(36')36\ PSF + \frac{36'(29\ PSF)9'}{3}$

$= 23.9\ K$

$W_E = 2'(80\ PSF) = 160\ PLF$

USE 12" x 24" CMU COL
W/ (4) # 6 VERTS AND # 3
TIES AT 8" O.C.
CC = 0.85 < 1.0, OK.
- SEE ATTACHED

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Column

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: CMU Columns/Walls Under Girder Support

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024 Rho (or Omega) = 1.00

General Information

Material Properties

F'm	=	2,500.0 psi
Fr - Rupture	=	75.0 psi
Em = f'm *	=	900.0
Column Density	=	130.0 pcf
Rebar Grade	=	Grade 60
Fy - Yield	=	60000 psi
Fs - Allowable	=	32,000.0 psi
E - Rebar	=	29,000.0 ksi

Column Data

Column width along X-X	=	23.625 in
Column depth along Y-Y	=	11.625 in
Longitudinal Bar Size	=	# 6.0
Bars per side at +Y & -Y	=	2
Bars per side at +X & -X	=	2
Cover from ties	=	3.50 in
Actual Edge to Bar Center	=	4.25 in

Analysis Settings

Analysis Method	=	**Allowable Design**
End Fixity Condition	=	Top Pinned, Bottom Pinned
Overall Column Height	=	30.0 ft
Construction Type		Solid Grouted Hollow Concrete Masor
Tie Bar Size	=	# 3
Tie Bar Spacing	=	8.0 in

Hoop/ties at ALL longitudinal bars

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 30.0 ft, K = 0.80
Y-Y (depth) axis : Fully braced against buckling ABOUT X-X Axis

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 7,438.18 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 30.0 ft, D = 11.50, S = 23.90 k
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, E = 0.160 k/ft

DESIGN SUMMARY

Bending Check Results

PASS **Maximum Bending Stress Ratio =** **0.848** : 1
Load Combination +0.60D+0.70E
Location of max.above base 14.899 ft
At maximum location values are . . .
Pu 11.363 k
0.9 * Pn 13.480 k
Mu-x 12.599 k-ft
0.9 * Mn-x : 14.795 k-ft

PASS **Reinforcing Area Check** *(TMS 402-22, Sec 5.4.1.3)*
As : Actual Reinforcement 1.760
Min: 0.0025 * An 0.687
Max: 0.04 * An 10.986

Dimensional Checks
Min. Side Dim. >= 8" *(TMS 402-22, Sec. 5.4.1.1(b))*
PASS Max K * Lu / r <= 99 *(TMS 402-22, Sec. 5.4.1.1(a))*
Kx Lu-xx / rx = 85.8 Ky Lu-yy / ry = 0.0

Maximum SERVICE Load Reactions . .
Top along X-X 2.400 k
Bottom along X-X 2.400 k

Max. SERVICE Load Deflections (Gross Section) . . .
Along x-x 0.424 in at 15.101 ft above base
for load combination : E Only L/ 849.0
Compressive Strength 151.431 k *(TMS 402-22, Sec. 8.3.4.2.1)*
Pa = (0.25*f'm*An + 0.65*Ast*Fs) * [1-(h/(140*r))^2]
*Solution is based on the assumption that compressive stress is 0.45 * f'm = 1125 psi*

PASS **Column Ties and Clear Cover Checks** *(TMS 402-22, Sec 5.4.1.4 & 6.1.4.2)*
Min. Allowable Tie Dia. = 1/4", # 3 bar provided
Max Allowable Tie Spacing = 11.63 in, Provided = 8.00 in
Min Allowable Clear Spacing between Long Bars = 1.50 in *<< See note below*
Provided clear spacing along X-axis = 14.38 in
Provided clear spacing along Y-axis = 2.38 in
Note: Per TMS 402-22 Sec. 5.3.1.4(c), no longitudinal bar shall be greater than 6 in clear on each side from a laterally supported bar. Verify your tie detailing is in conformance.

Load Combination Results

Load Combination	Maximum Bending Stress Ratios Stress Ratio	Status	Location	Maximum Axial Load Actual	Allow	Maximum Moments Actual	Allow
D Only	0.1230	PASS	0.0 ft	18.938 k	151.250 k	0.0 k-ft	28.612 k-ft
+D+0.70S	0.2317	PASS	0.0 ft	35.668 k	151.250 k	0.0 k-ft	28.612 k-ft
+D+0.5250S	0.2045	PASS	0.0 ft	31.486 k	151.250 k	0.0 k-ft	28.612 k-ft
+0.60D	0.07382	PASS	0.0 ft	11.363 k	151.250 k	0.0 k-ft	28.612 k-ft
+D+0.70E	0.6796	PASS	14.899 ft	18.938 k	27.876 k	12.599 k-ft	18.526 k-ft
+D+0.10S+0.5250E	0.4201	PASS	14.899 ft	21.328 k	50.798 k	9.450 k-ft	22.436 k-ft

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Column

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: CMU Columns/Walls Under Girder Support

Load Combination Results

Load Combination	Maximum Bending Stress Ratios Stress Ratio	Status	Location	Maximum Axial Load Actual	Allow	Maximum Moments Actual	Allow
+0.60D+0.70E	0.8477	PASS	14.899 ft	11.363 k	13.480 k	12.599 k-ft	14.795 k-ft

Reactions for Load Cases

Note: Only non-zero reactions are listed.

Load Combination	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base
D Only	k	k	18.938 k
S Only	k	k	23.900 k
E Only	2.400 k	2.400 k	k

Reactions for Load Combinations

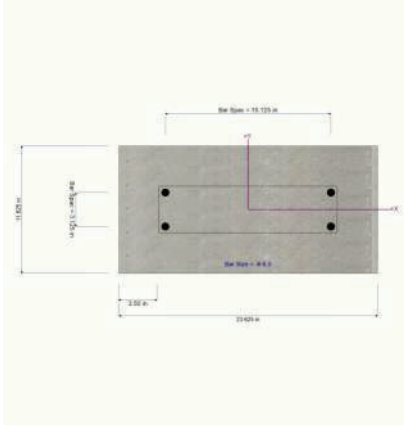
Note: Only non-zero reactions are listed.

Load Combination	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base
+D+0.70S	k	k	35.668 k
+D+0.5250S	k	k	31.486 k
+0.60D	k	k	11.363 k
+D+0.70E	1.680 k	1.680 k	18.938 k
+D+0.10S+0.5250E	1.260 k	1.260 k	21.328 k
+0.60D+0.70E	1.680 k	1.680 k	11.363 k

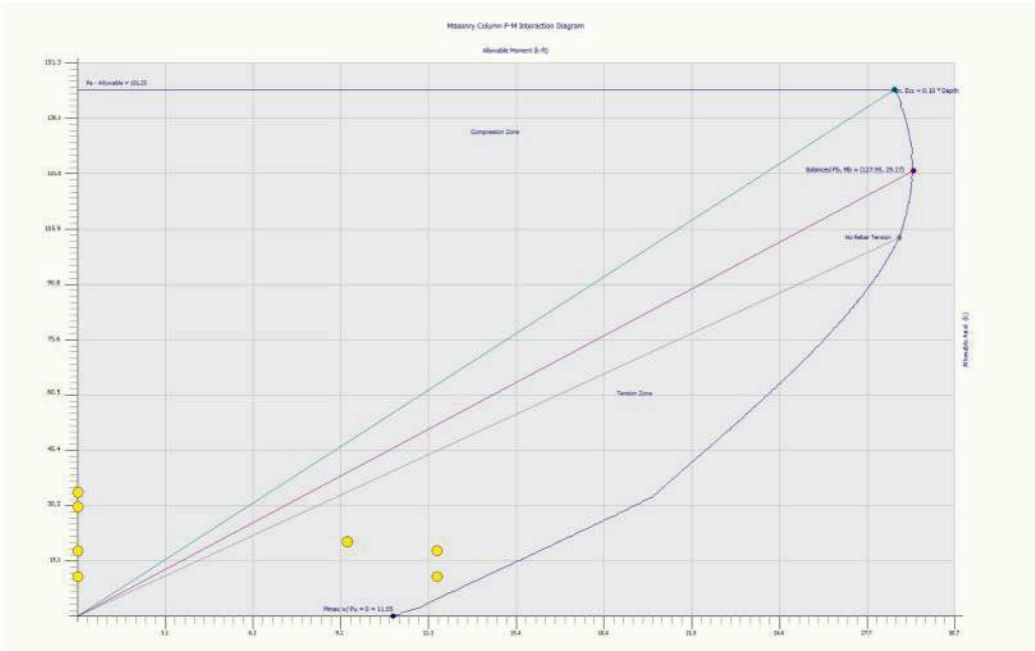
Maximum Deflections for Load Combinations (Gross Section)

Load Combination	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft
+D+0.70S	0.0000 in	0.000 ft
+D+0.5250S	0.0000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft
+D+0.70E	0.2965 in	15.101 ft
+D+0.10S+0.5250E	0.2224 in	15.101 ft
+0.60D+0.70E	0.2965 in	15.101 ft
+0.70E	0.2965 in	15.101 ft
+0.70S	0.0000 in	0.000 ft
S Only	0.0000 in	0.000 ft
E Only	0.4235 in	15.101 ft

Cross Section

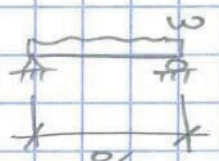


Interaction Diagram



DESIGN CMU LINTELS ($f'_m = 2000$ PSI)

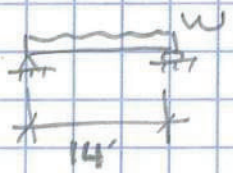
- 12" CMU, 8' MAX SPAN, DEPTH = 2'-8"



$w_D = 18.3'(20\ PSF) + 16.7'(120\ PSF)$
$= 2370\ PLF$
$w_S = 18.3'(36\ PSF) + \frac{9'(29\ PSF)}{2}$
$= 789\ PLF$

USE (2) #5 HORIZ AT BOT. MIN
CC = 0.79 < 1, OK
- SEE ATTACHED

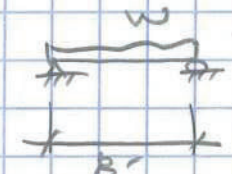
- 12" CMU, 14' MAX SPAN, DEPTH = 4'-0"



$w_D = 17'(20\ PSF) + 28'(120\ PSF)$
$= 3.7\ KLF$
$w_S = 17'(36\ PSF) + \frac{9'(25\ PSF)}{2}$
$= 725\ PLF$

USE (4) #6 HORIZ AT BOT MIN
CC = 0.86 < 1.0, OK
- SEE ATTACHED

- 8" CMU, 8'-MAX SPAN, DEPTH = 2'-8"



$w_D = 24'(80\ PSF) + 4'(20\ PSF)$
$= 2.08\ KLF$
$w_S = 4'(56\ PSF) = 224\ PLF$

USE (2) #5 AT BOTTOM MIN
CC = 0.63 < 1.0, OK
- SEE ATTACHED

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Lintel: 12" CMU, 8' Span, 2'-8" Depth

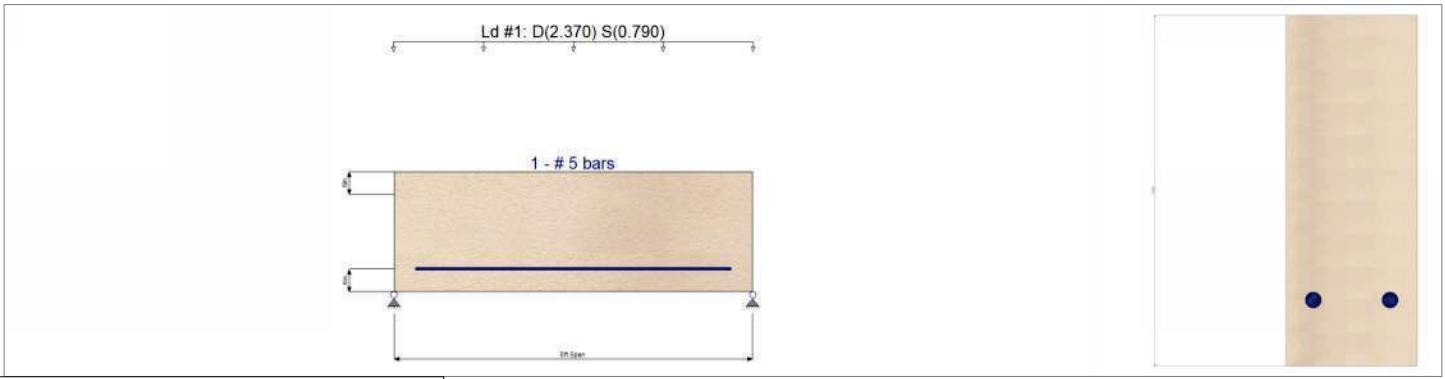
Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

f'm	2,000.0	psi	Clear Span	8.0 ft	Rebar Size	5	
Fs	24,000.0	psi	Beam Depth	2.670 ft	# Bars E/F	1	
Em = f'm *	750.0		Thickness	12 in	Top Clear	6.0	in
Wall Wt Mult.	1.0		End Fixity	Pin-Pin	Btm Clear	6.0	in
Block Type	Medium Wt		Equiv. Solid Thick	11.60 in	# Bar Sets	1	
Lateral Wind Load	54.0	psf	Wall Weight	125.0 psf	Bar Spacing	7.0	in
Beam is Fully Braced ?	Yes		E	1,500.0 ksi			
Lateral Wall Weight Seismic Factor	0.670		n	19.333			
Calculate vertical beam weight ?	No						



Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	0.0 ft	8.0 ft	2.370			0.790		k/ft
#2	ft	ft						k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft
#5		ft						k/ft
#6		ft						k/ft
#7		ft						k/ft
#8		ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...

	Vertical	Lateral	SRSS Combination
fb/Fb	0.7885	0.0	**0.7885** : 1.00
fv/Fv	0.5220	0.0	**0.5220** : 1.00

Minimum Mn = 1.3 * Fcr * S = 21.547 k-ft

Maximum Moment

	Actual	Allowable
Vertical Loads	23.384 k-ft	29.657 k-ft
for Load Combination	+D+0.70S	
Lateral Loads	1.252 k-ft	5.425 k-ft
for Load Combination	+D+0.70E	

Maximum Shear

	Actual	Allowable
Vertical Loads	31.391 psi	60.131 psi
for Load Combination	+D+0.70S	
Lateral Loads	2.098 psi	44.721 psi
for Load Combination	+D+0.70E	

Lateral Support of Compression Face

Actual	Allowable		
0.0 in	372.0 in	b = 11.625 in	32b = 372.0 in
		d = 26.040 in	120b^2/d = 622.77 in

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Lintel: 12" CMU, 8' Span, 2'-8" Depth

Vertical Strength

As	0.620	in^2
ρ	0.002048	
n ρ	0.03960	
k = [(n ρ)^2 + 2 n ρ]^0.5 - (n ρ)	0.2446	
j = 1 - k/3	0.9185	
M:mas = Fb k j b d^2 / 2	66.406	k-ft
M:Stl = Fs As j d	29.657	k-ft

Lateral Strength

(Checking lateral bending for span)

As	0.310	in^2
ρ	0.001039	
n ρ	0.02009	
k = [(n ρ)^2 + 2 n ρ]^0.5 - (n ρ)	0.1814	
j = 1 - k/3	0.9396	
M:mas = Fb k j b d^2 / 2	17.754	k-ft
M:Stl = Fs As j d	5.425	k-ft

Detailed Load Combination Results

Load Combinatic	Vertical				Lateral			
	Mmax k-ft	Mallow k-ft	fv psi	Fv psi	Mactual k-ft	Mallow k-ft	fv psi	Fv psi
D Only	18.96	29.66	25.45	60.13	0.00	5.42	0.00	44.72
+D+0.70S	23.38	29.66	31.39	60.13	0.00	5.42	0.00	44.72
+D+0.5250S	22.28	29.66	29.91	60.13	0.00	5.42	0.00	44.72
+D+0.60W	18.96	29.66	25.45	60.13	0.69	5.42	1.16	44.72
+D-0.60W	18.96	29.66	25.45	60.13	0.69	5.42	1.16	44.72
+D+0.450W	18.96	29.66	25.45	60.13	0.52	5.42	0.87	44.72
+D-0.450W	18.96	29.66	25.45	60.13	0.52	5.42	0.87	44.72
+D+0.5250S+0.450W	22.28	29.66	29.91	60.13	0.52	5.42	0.87	44.72
+D+0.5250S-0.450W	22.28	29.66	29.91	60.13	0.52	5.42	0.87	44.72
+0.60D+0.60W	11.38	29.66	15.27	60.13	0.69	5.42	1.16	44.72
+0.60D-0.60W	11.38	29.66	15.27	60.13	0.69	5.42	1.16	44.72
+D+0.70E	18.96	29.66	25.45	60.13	1.25	5.42	2.10	44.72
+D-0.70E	18.96	29.66	25.45	60.13	1.25	5.42	2.10	44.72
+D+0.10S+0.5250E	19.59	29.66	26.30	60.13	0.94	5.42	1.57	44.72
+D+0.10S-0.5250E	19.59	29.66	26.30	60.13	0.94	5.42	1.57	44.72
+0.60D+0.70E	11.38	29.66	15.27	60.13	1.25	5.42	2.10	44.72
+0.60D-0.70E	11.38	29.66	15.27	60.13	1.25	5.42	2.10	44.72
D Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Vertical Reactions for Load Cases

Load Combination	Left k	Right k
D Only	9.480	9.480
D Only	9.480	9.480
S Only	3.160	3.160
W Only	0.000	0.000
E Only	0.000	0.000

Vertical Reactions for Load Combinations

Load Combination	Left k	Right k
+D+0.70S	11.692	11.692
+D+0.5250S	11.139	11.139
+D+0.60W	9.480	9.480
+D-0.60W	9.480	9.480

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Lintel: 12" CMU, 8' Span, 2'-8" Depth

Vertical Reactions for Load Combinations

Load Combination	Left	Right
	k	k
+D+0.450W	9.480	9.480
+D-0.450W	9.480	9.480
+D+0.5250S+0.450W	11.139	11.139
+D+0.5250S-0.450W	11.139	11.139
+0.60D+0.60W	5.688	5.688
+0.60D-0.60W	5.688	5.688
+D+0.70E	9.480	9.480
+D-0.70E	9.480	9.480
+D+0.10S+0.5250E	9.796	9.796
+D+0.10S-0.5250E	9.796	9.796
+0.60D+0.70E	5.688	5.688
+0.60D-0.70E	5.688	5.688

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Lintel: 12" CMU, 14' Span, 4'-0" Depth

Code References

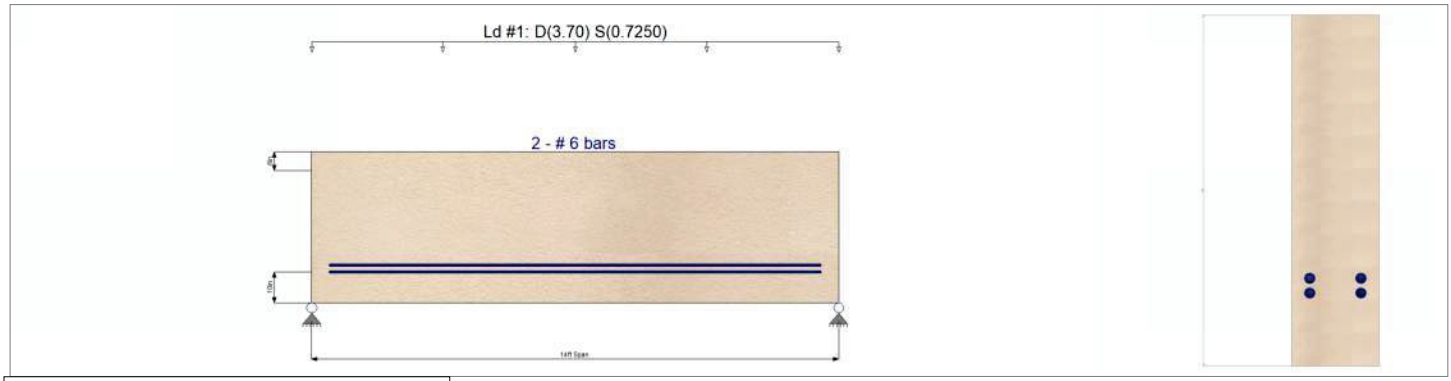
Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

f'm	2,000.0 psi		Clear Span	14.0 ft	Rebar Size	6.0	
Fs	24,000.0 psi		Beam Depth	4.0 ft	# Bars E/F	2	
Em = f'm *	750.0		Thickness	12 in	Top Clear	6.0	in
Wall Wt Mult.	1.0		End Fixity	Pin-Pin	Btm Clear	10.0	in
Block Type	Medium Wt		Equiv. Solid Thick	11.60 in	# Bar Sets	1	
Lateral Wind Load	54.0 psf		Wall Weight	125.0 psf	Bar Spacing	7.0	in
Beam is Fully Braced ?		Yes	E	1,500.0 ksi			
Lateral Wall Weight Seismic Factor		0.670	n	19.333			
Calculate vertical beam weight ?		No					

Note! Shear calculated at "d/2" from edge of bear



Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	ft	14.0 ft	3.70			0.7250		k/ft
#2	ft	ft						k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft
#5		ft						k/ft
#6		ft						k/ft
#7		ft						k/ft
#8		ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...

	Vertical	Lateral	SRSS Combination
fb/Fb	0.8636	0.0	**0.8636** : 1.00
fv/Fv	0.8146	0.0	**0.8146** : 1.00

Minimum Mn = 1.3 * Fcr * S = 48.360 k-ft

Maximum Moment

	Actual	Allowable
Vertical Loads	103.083 k-ft	119.360 k-ft
for Load Combination	+D+0.70S	
Lateral Loads	5.743 k-ft	15.076 k-ft
for Load Combination	+D+0.70E	

Maximum Shear

	Actual	Allowable
Vertical Loads	40.986 psi	50.312 psi
for Load Combination	+D+0.70S	
Lateral Loads	3.672 psi	44.721 psi
for Load Combination	+D+0.70E	

Lateral Support of Compression Face

Actual	Allowable		
0.0 in	372.0 in	b = 11.625 in	32b = 372.0 in
		d = 38.0 in	120b^2/d = 426.760 in

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Lintel: 12" CMU, 14' Span, 4'-0" Depth

Vertical Strength

As	1.760	in^2
ρ	0.003984	
n ρ	0.07703	
k = [(n ρ)^2 + 2 n ρ]^0.5 - (n ρ)	0.3230	
j = 1 - k/3	0.8923	
M:mas = Fb k j b d^2 / 2	181.414	k-ft
M:Stl = Fs As j d	119.360	k-ft

Lateral Strength

(Checking lateral bending for span)

As	0.880	in^2
ρ	0.001969	
n ρ	0.03806	
k = [(n ρ)^2 + 2 n ρ]^0.5 - (n ρ)	0.2405	
j = 1 - k/3	0.9198	
M:mas = Fb k j b d^2 / 2	34.527	k-ft
M:Stl = Fs As j d	15.076	k-ft

Detailed Load Combination Results

Load Combinatic	Vertical				Lateral			
	Mmax k-ft	Mallow k-ft	fv psi	Fv psi	Mactual k-ft	Mallow k-ft	fv psi	Fv psi
D Only	90.65	119.36	36.04	50.31	0.00	15.08	0.00	44.72
+D+0.70S	103.08	119.36	40.99	50.31	0.00	15.08	0.00	44.72
+D+0.5250S	99.97	119.36	39.75	50.31	0.00	15.08	0.00	44.72
+D+0.60W	90.65	119.36	36.04	50.31	3.17	15.08	2.03	44.72
+D-0.60W	90.65	119.36	36.04	50.31	3.17	15.08	2.03	44.72
+D+0.450W	90.65	119.36	36.04	50.31	2.38	15.08	1.52	44.72
+D-0.450W	90.65	119.36	36.04	50.31	2.38	15.08	1.52	44.72
+D+0.5250S+0.450W	99.97	119.36	39.75	50.31	2.38	15.08	1.52	44.72
+D+0.5250S-0.450W	99.97	119.36	39.75	50.31	2.38	15.08	1.52	44.72
+0.60D+0.60W	54.39	119.36	21.63	50.31	3.17	15.08	2.03	44.72
+0.60D-0.60W	54.39	119.36	21.63	50.31	3.17	15.08	2.03	44.72
+D+0.70E	90.65	119.36	36.04	50.31	5.74	15.08	3.67	44.72
+D-0.70E	90.65	119.36	36.04	50.31	5.74	15.08	3.67	44.72
+D+0.10S+0.5250E	92.43	119.36	36.75	50.31	4.31	15.08	2.75	44.72
+D+0.10S-0.5250E	92.43	119.36	36.75	50.31	4.31	15.08	2.75	44.72
+0.60D+0.70E	54.39	119.36	21.63	50.31	5.74	15.08	3.67	44.72
+0.60D-0.70E	54.39	119.36	21.63	50.31	5.74	15.08	3.67	44.72
D Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Vertical Reactions for Load Cases

Load Combination	Left	Right
	k	k
D Only	25.900	25.900
D Only	25.900	25.900
S Only	5.075	5.075
W Only	0.000	0.000
E Only	0.000	0.000

Vertical Reactions for Load Combinations

Load Combination	Left	Right
	k	k
+D+0.70S	29.453	29.453
+D+0.5250S	28.564	28.564
+D+0.60W	25.900	25.900
+D-0.60W	25.900	25.900

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Lintel: 12" CMU, 14' Span, 4'-0" Depth

Vertical Reactions for Load Combinations

Load Combination	Left	Right
	k	k
+D+0.450W	25.900	25.900
+D-0.450W	25.900	25.900
+D+0.5250S+0.450W	28.564	28.564
+D+0.5250S-0.450W	28.564	28.564
+0.60D+0.60W	15.540	15.540
+0.60D-0.60W	15.540	15.540
+D+0.70E	25.900	25.900
+D-0.70E	25.900	25.900
+D+0.10S+0.5250E	26.408	26.408
+D+0.10S-0.5250E	26.408	26.408
+0.60D+0.70E	15.540	15.540
+0.60D-0.70E	15.540	15.540

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Lintel: 8" CMU, 8' Span, 2'-8" Depth

Code References

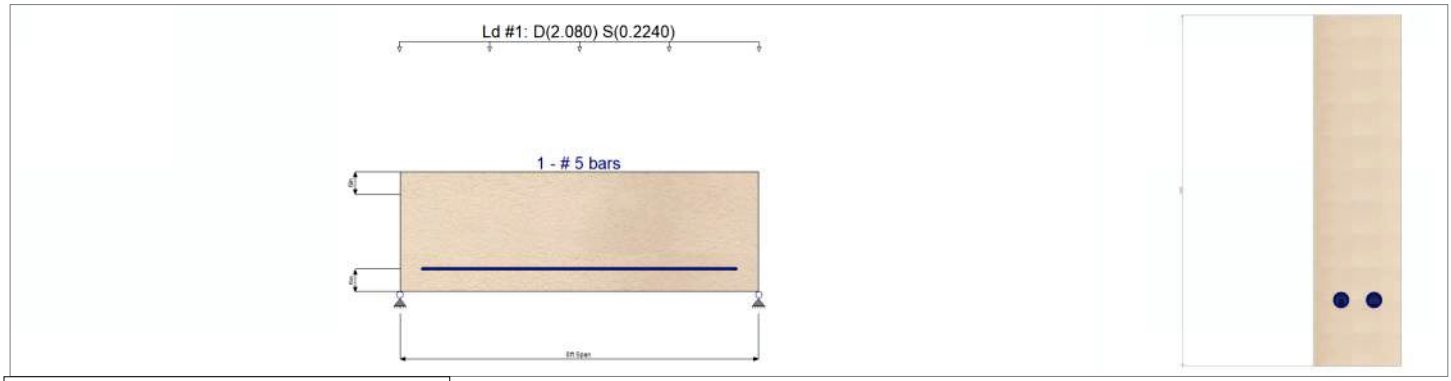
Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

f'm	2,000.0 psi		Clear Span	8.0 ft	Rebar Size	5	
Fs	24,000.0 psi		Beam Depth	2.670 ft	# Bars E/F	1	
Em = f'm *	750.0		Thickness	8 in	Top Clear	6.0	in
Wall Wt Mult.	1.0		End Fixity	Pin-Pin	Btm Clear	6.0	in
Block Type	Medium Wt		Equiv. Solid Thick	7.60 in	# Bar Sets	1	
Lateral Wind Load	54.0 psf		Wall Weight	81.0 psf	Bar Spacing	3.0	in
Beam is Fully Braced ?		Yes	E	1,500.0 ksi			
Lateral Wall Weight Seismic Factor		0.670	n	19.333			
Calculate vertical beam weight ?		No					

Note! Shear calculated at "d/2" from edge of bear



Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	ft	8.0 ft	2.080			0.2240		k/ft
#2	ft	ft						k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft
#5		ft						k/ft
#6		ft						k/ft
#7		ft						k/ft
#8		ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...

	Vertical	Lateral	SRSS Combination
fb/Fb	0.5710	0.2669	**0.6303** : 1.00
fv/Fv	0.5319	0.0	**0.5319** : 1.00

Minimum Mn = 1.3 * Fcr * S = 14.133 k-ft

Maximum Moment

	Actual	Allowable
Vertical Loads	17.894 k-ft	29.143 k-ft
for Load Combination	+D+0.70S	
Lateral Loads	0.8111 k-ft	3.039 k-ft
for Load Combination	+D+0.70E	

Maximum Shear

	Actual	Allowable
Vertical Loads	26.759 psi	50.312 psi
for Load Combination	+D+0.70S	
Lateral Loads	2.384 psi	44.721 psi
for Load Combination	+D+0.70E	

Lateral Support of Compression Face

Actual	Allowable		
0.0 in	244.0 in	b = 7.625 in	32b = 244.0 in
		d = 26.040 in	120b^2/d = 267.929 in

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Lintel: 8" CMU, 8' Span, 2'-8" Depth

Vertical Strength

As	0.620	in^2
ρ	0.003123	
n ρ	0.06037	
k = [(n ρ)^2 + 2 n ρ]^0.5 - (n ρ)	0.2923	
j = 1 - k/3	0.9026	
M:mas = Fb k j b d^2 / 2	51.154	k-ft
M:Stl = Fs As j d	29.143	k-ft

Lateral Strength

(Checking lateral bending for span)

As	0.310	in^2
ρ	0.001821	
n ρ	0.03521	
k = [(n ρ)^2 + 2 n ρ]^0.5 - (n ρ)	0.2325	
j = 1 - k/3	0.9225	
M:mas = Fb k j b d^2 / 2	7.273	k-ft
M:Stl = Fs As j d	3.039	k-ft

Detailed Load Combination Results

Load Combinatic	Vertical				Lateral			
	Mmax k-ft	Mallow k-ft	fv psi	Fv psi	Mactual k-ft	Mallow k-ft	fv psi	Fv psi
D Only	16.64	29.14	24.88	50.31	0.00	3.04	0.00	44.72
+D+0.70S	17.89	29.14	26.76	50.31	0.00	3.04	0.00	44.72
+D+0.5250S	17.58	29.14	26.29	50.31	0.00	3.04	0.00	44.72
+D+0.60W	16.64	29.14	24.88	50.31	0.69	3.04	2.03	44.72
+D-0.60W	16.64	29.14	24.88	50.31	0.69	3.04	2.03	44.72
+D+0.450W	16.64	29.14	24.88	50.31	0.52	3.04	1.52	44.72
+D-0.450W	16.64	29.14	24.88	50.31	0.52	3.04	1.52	44.72
+D+0.5250S+0.450W	17.58	29.14	26.29	50.31	0.52	3.04	1.52	44.72
+D+0.5250S-0.450W	17.58	29.14	26.29	50.31	0.52	3.04	1.52	44.72
+0.60D+0.60W	9.98	29.14	14.93	50.31	0.69	3.04	2.03	44.72
+0.60D-0.60W	9.98	29.14	14.93	50.31	0.69	3.04	2.03	44.72
+D+0.70E	16.64	29.14	24.88	50.31	0.81	3.04	2.38	44.72
+D-0.70E	16.64	29.14	24.88	50.31	0.81	3.04	2.38	44.72
+D+0.10S+0.5250E	16.82	29.14	25.15	50.31	0.61	3.04	1.79	44.72
+D+0.10S-0.5250E	16.82	29.14	25.15	50.31	0.61	3.04	1.79	44.72
+0.60D+0.70E	9.98	29.14	14.93	50.31	0.81	3.04	2.38	44.72
+0.60D-0.70E	9.98	29.14	14.93	50.31	0.81	3.04	2.38	44.72
D Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E Only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Vertical Reactions for Load Cases

Load Combination	Left	Right
	k	k
D Only	8.320	8.320
D Only	8.320	8.320
S Only	0.896	0.896
W Only	0.000	0.000
E Only	0.000	0.000

Vertical Reactions for Load Combinations

Load Combination	Left	Right
	k	k
+D+0.70S	8.947	8.947
+D+0.5250S	8.790	8.790
+D+0.60W	8.320	8.320
+D-0.60W	8.320	8.320

Project Title:
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Project ID:
Project Descr:

Masonry Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Lintel: 8" CMU, 8' Span, 2'-8" Depth

Vertical Reactions for Load Combinations

Load Combination	Left	Right
	k	k
+D+0.450W	8.320	8.320
+D-0.450W	8.320	8.320
+D+0.5250S+0.450W	8.790	8.790
+D+0.5250S-0.450W	8.790	8.790
+0.60D+0.60W	4.992	4.992
+0.60D-0.60W	4.992	4.992
+D+0.70E	8.320	8.320
+D-0.70E	8.320	8.320
+D+0.10S+0.5250E	8.410	8.410
+D+0.10S-0.5250E	8.410	8.410
+0.60D+0.70E	4.992	4.992
+0.60D-0.70E	4.992	4.992

DESIGN WALL FOOTINGS TO INCLUDE FUTURE ADDITION

VERT LOADS FROM CURRENT STEAM PROJECT

$P_D = 17'(20\ PSF) + 38'(120\ PSF) = 4.9\ KLF$

$P_S = 17'(36\ PSF) + \frac{9'(29\ PSF)}{2} = 0.7\ KLF$

VERT LOADS FROM FUTURE ADDITION

ROOF/WALL

$P_D = 16'(27\ PSF) + 38'(120\ PSF) = 5.0\ KLF$

$P_S = 16'(36\ PSF) + \frac{70\ PSF(18')}{2} = 1.2\ KLF$

FLOOR

$P_D = 16'(70\ PSF) = 1.1\ KLF$

$P_L = 16'(100\ PSF) = 1.6\ KLF$

WIDTH REQ'D FOR STEAM

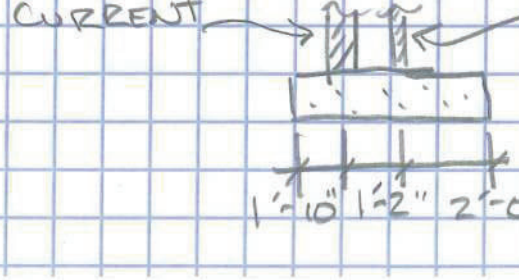
$\frac{\Sigma P_{D+0.75S}}{3.5\ KSF} = \frac{5.6\ KLF}{3.5\ KSF} = 1.6'$

WIDTH REQ'D FOR FUTURE ADDN

$\Sigma P_{D+0.75L} = \frac{8.5\ KLF}{3.5\ KSF} = 2.4'$

$\Sigma = 4'-0"$

USE 5'-0" WIDE CONT FTG MIN
- 12" THICK MIN
- #5 TRANSVERSE AT 12" o.c. MIN



-SEE ATTACHED

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Wall Ftg

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-22 / IBC 2024 Rho (or Omega) = 1.00

General Information

Material Properties

f'c : Concrete 28 day strength	3.0	ksi
fy : Rebar Yield	60.0	ksi
Ec : Concrete Elastic Modulus	3,122.0	ksi
Concrete Density	145.0	pcf
ϕ : Phi Values Flexure :	0.90	
Shear :	0.750	

Analysis/Design Settings

Calculate footing weight as dead load ?	No
Calculate Pedestal weight as dead load ?	No
Min Steel Ratio per ACI 7.6.1.1 (ratio=Steel Area/Concrete Area)	0.0018
Min. Overturning Safety Factor	1.0: 1
Min. Sliding Safety Factor	1.0: 1

Soil Information

Allowable Soil Bearing	3.50	ksf
Increase Bearing By Footing Weight	Yes	
Soil Passive Sliding Resistance	250.0	pcf
(Uses entry for "Footing base depth below soil surface" for force)		
Coefficient of Soil/Concrete Friction	0.30	

Soil Bearing Increase

Footing base depth below soil surface	3.0 ft
Increases based on footing Depth	
Allowable pressure increase per foot	ksf
when base of footing is below	ft
Increases based on footing Width . . .	
Allowable pressure increase per foot	ksf
when maximum length or width is greater tha	ft
Maximum Allowed Bearing Pressure	10.0 ksf
(A value of zero implies no limit)	
Adjusted Allowable Soil Bearing	3.645 ksf
(Allowable Soil Bearing adjusted for footing weight and depth & width increases as specified by user.)	

Dimensions & Reinforcing

Distance Left of Column #1	=	1.830 ft
Between Columns	=	1.170 ft
Distance Right of Column #2	=	2.0 ft
Total Footing Length	=	5.0 ft
Footing Width	=	1.0 ft
Footing Thickness	=	12.0 in
Rebar Center to Concrete Edge @ Top	=	3.0 in
Rebar Center to Concrete Edge @ Bottom	=	3.750 in

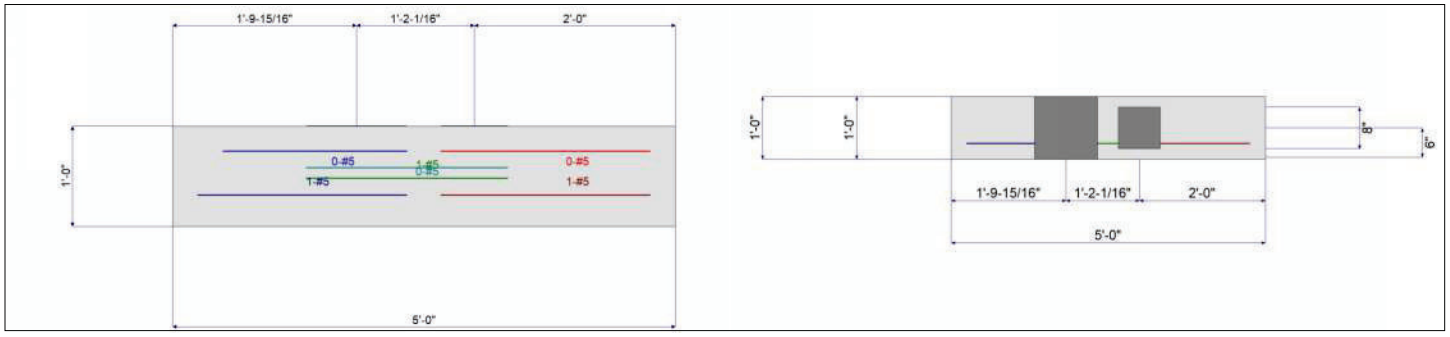
Pedestal dimensions...

		Col #1	Col #2	
Sq. Dim.	=	12.0	8.0	in
Height	=			in

	Count	Size #	As Provided
Bars left of Col #1			
Bottom Bars	1.0	5	0.310
Top Bars		5	0.0
Bars Btwn Cols			
Bottom Bars	1.0	5	0.310
Top Bars		5	0.0
Bars Right of Col #2			
Bottom Bars	1.0	5	0.310
Top Bars		5	0.0

Applied Loads

		D	Lr	L	S	W	E	H	
Applied @ Left Column									
Axial Load Downward	=	4.90		0.70					k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Applied @ Right Column									
Axial Load Downward	=	6.10		1.60	1.20				k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Overburden	=								



Project Title:
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Combined Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Wall Ftg

DESIGN SUMMARY

Hand Calc Req'd

Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS No OTM	Overturning	0.0 k-ft	0.0 k-ft	No OTM
PASS No Sliding	Sliding	0.0 k	4.160 k	No Sliding
PASS No Uplift	Uplift	0.0 k	0.0 k	No Uplift

Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS 0.8269	Soil Bearing	3.014 ksf	3.645 ksf	+D+0.750L+0.5250S
PASS 0.4495	1-way Shear - Col #1	21.610 psi	48.079 psi	+1.20D+1.60L+0.30S
PASS 0.7231	1-way Shear - Col #2	34.765 psi	48.079 psi	+1.20D+1.60L+0.30S
	2-way Punching - Col #1	Hand check required due to small edge distances.		
	2-way Punching - Col #2	Hand check required due to small edge distances.		
PASS No Tension	Flexure - Left of Col #1 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS 0.2407	Flexure - Left of Col #1 - Bottom	2.668 k-ft	11.085 k-ft	+1.20D+1.60L+0.30S
PASS No Tension	Flexure - Between Cols - Top	0.0 k-ft	0.0 k-ft	N/A
PASS 0.5239	Flexure - Between Cols - Bottom	5.807 k-ft	11.085 k-ft	+1.20D+1.60L+0.30S
PASS No Tension	Flexure - Right of Col #2 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS 0.4148	Flexure - Right of Col #2 - Bottom	4.598 k-ft	11.085 k-ft	+1.20D+1.60L+0.30S

Soil Bearing

Load Combination...	Total Bearing	Eccentricity from Ftg CL	Actual Soil Bearing Stress @ Left Edge	@ Right Edge	Allowable	Actual / Allow Ratio
D Only	12.32 k	-0.019 ft	2.52 ksf	2.41 ksf	3.65 ksf	0.691
+D+L	14.62 k	0.007 ft	2.90 ksf	2.95 ksf	3.65 ksf	0.809
+D+0.70S	13.16 k	0.014 ft	2.59 ksf	2.68 ksf	3.65 ksf	0.734
+D+0.750L	14.05 k	0.001 ft	2.81 ksf	2.81 ksf	3.65 ksf	0.772
+D+0.750L+0.5250S	14.68 k	0.023 ft	2.86 ksf	3.01 ksf	3.65 ksf	0.827
+0.60D	7.92 k	-0.018 ft	1.62 ksf	1.55 ksf	3.65 ksf	0.444
+D+0.750L+0.10S	14.17 k	0.005 ft	2.81 ksf	2.85 ksf	3.65 ksf	0.782

Overturning Stability

Load Combination...	Moments about Left Edge k-ft Overturning	Resisting	Ratio	Moments about Right Edg k-ft Overturning	Resisting	Ratio
D Only	0.00	0.00	999.000	0.00	0.00	999.000
+D+L	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.70S	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750L	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750L+0.5250S	0.00	0.00	999.000	0.00	0.00	999.000
+0.60D	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750L+0.10S	0.00	0.00	999.000	0.00	0.00	999.000

Sliding Stability

Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio
D Only	0.00 k	4.16 k	999
+D+L	0.00 k	4.85 k	999
+D+0.70S	0.00 k	4.41 k	999
+D+0.750L	0.00 k	4.68 k	999
+D+0.750L+0.5250S	0.00 k	4.87 k	999
+0.60D	0.00 k	2.75 k	999
+D+0.750L+0.10S	0.00 k	4.71 k	999

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+D+0.750L+0.10S	0.000	0.000	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.013	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.025	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.038	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.050	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.063	0	0.000	0	0.000	0.000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Wall Ftg

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+D+0.750L+0.10S	0.000	0.075	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.088	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.100	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.113	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.125	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.138	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.150	0	0.000	0	0.000	0.000	0.000
+D+0.750L+0.10S	0.000	0.163	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.014	0.175	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.001
+1.20D+1.60L+0.30S	0.019	0.188	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.002
+1.20D+1.60L+0.30S	0.024	0.200	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.002
+1.20D+1.60L+0.30S	0.030	0.213	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.003
+1.20D+1.60L+0.30S	0.037	0.225	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.003
+1.20D+1.60L+0.30S	0.044	0.238	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.004
+1.20D+1.60L+0.30S	0.051	0.250	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.005
+1.20D+1.60L+0.30S	0.059	0.263	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.005
+1.20D+1.60L+0.30S	0.068	0.275	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.006
+1.20D+1.60L+0.30S	0.077	0.288	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.007
+1.20D+1.60L+0.30S	0.086	0.300	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.008
+1.20D+1.60L+0.30S	0.097	0.313	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.009
+1.20D+1.60L+0.30S	0.107	0.325	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.010
+1.20D+1.60L+0.30S	0.118	0.338	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.011
+1.20D+1.60L+0.30S	0.130	0.350	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.012
+1.20D+1.60L+0.30S	0.142	0.363	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.013
+1.20D+1.60L+0.30S	0.155	0.375	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.014
+1.20D+1.60L+0.30S	0.168	0.388	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.015
+1.20D+1.60L+0.30S	0.182	0.400	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.016
+1.20D+1.60L+0.30S	0.197	0.413	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.018
+1.20D+1.60L+0.30S	0.212	0.425	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.019
+1.20D+1.60L+0.30S	0.227	0.438	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.020
+1.20D+1.60L+0.30S	0.243	0.450	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.022
+1.20D+1.60L+0.30S	0.259	0.463	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.023
+1.20D+1.60L+0.30S	0.276	0.475	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.025
+1.20D+1.60L+0.30S	0.294	0.488	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.027
+1.20D+1.60L+0.30S	0.312	0.500	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.028
+1.20D+1.60L+0.30S	0.330	0.513	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.030
+1.20D+1.60L+0.30S	0.349	0.525	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.032
+1.20D+1.60L+0.30S	0.369	0.538	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.033
+1.20D+1.60L+0.30S	0.389	0.550	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.035
+1.20D+1.60L+0.30S	0.410	0.563	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.037
+1.20D+1.60L+0.30S	0.431	0.575	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.039
+1.20D+1.60L+0.30S	0.453	0.588	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.041
+1.20D+1.60L+0.30S	0.475	0.600	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.043
+1.20D+1.60L+0.30S	0.498	0.613	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.045
+1.20D+1.60L+0.30S	0.521	0.625	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.047
+1.20D+1.60L+0.30S	0.545	0.638	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.049
+1.20D+1.60L+0.30S	0.569	0.650	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.051
+1.20D+1.60L+0.30S	0.594	0.663	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.054
+1.20D+1.60L+0.30S	0.619	0.675	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.056
+1.20D+1.60L+0.30S	0.645	0.688	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.058
+1.20D+1.60L+0.30S	0.672	0.700	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.061
+1.20D+1.60L+0.30S	0.699	0.713	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.063
+1.20D+1.60L+0.30S	0.726	0.725	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.066
+1.20D+1.60L+0.30S	0.754	0.738	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.068
+1.20D+1.60L+0.30S	0.783	0.750	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.071
+1.20D+1.60L+0.30S	0.812	0.763	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.073
+1.20D+1.60L+0.30S	0.842	0.775	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.076
+1.20D+1.60L+0.30S	0.872	0.788	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.079
+1.20D+1.60L+0.30S	0.902	0.800	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.081
+1.20D+1.60L+0.30S	0.934	0.813	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.084
+1.20D+1.60L+0.30S	0.965	0.825	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.087
+1.20D+1.60L+0.30S	0.998	0.838	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.090
+1.20D+1.60L+0.30S	1.030	0.850	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.093

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Wall Ftg

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60L+0.30S	1.064	0.863	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.096
+1.20D+1.60L+0.30S	1.098	0.875	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.099
+1.20D+1.60L+0.30S	1.132	0.888	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.102
+1.20D+1.60L+0.30S	1.167	0.900	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.105
+1.20D+1.60L+0.30S	1.202	0.913	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.108
+1.20D+1.60L+0.30S	1.238	0.925	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.112
+1.20D+1.60L+0.30S	1.275	0.938	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.115
+1.20D+1.60L+0.30S	1.312	0.950	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.118
+1.20D+1.60L+0.30S	1.349	0.963	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.122
+1.20D+1.60L+0.30S	1.387	0.975	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.125
+1.20D+1.60L+0.30S	1.426	0.988	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.129
+1.20D+1.60L+0.30S	1.465	1.000	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.132
+1.20D+1.60L+0.30S	1.505	1.013	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.136
+1.20D+1.60L+0.30S	1.545	1.025	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.139
+1.20D+1.60L+0.30S	1.586	1.038	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.143
+1.20D+1.60L+0.30S	1.627	1.050	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.147
+1.20D+1.60L+0.30S	1.669	1.063	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.151
+1.20D+1.60L+0.30S	1.711	1.075	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.154
+1.20D+1.60L+0.30S	1.754	1.088	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.158
+1.20D+1.60L+0.30S	1.797	1.100	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.162
+1.20D+1.60L+0.30S	1.841	1.113	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.166
+1.20D+1.60L+0.30S	1.885	1.125	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.170
+1.20D+1.60L+0.30S	1.930	1.138	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.174
+1.20D+1.60L+0.30S	1.976	1.150	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.178
+1.20D+1.60L+0.30S	2.022	1.163	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.182
+1.20D+1.60L+0.30S	2.068	1.175	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.187
+1.20D+1.60L+0.30S	2.115	1.188	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.191
+1.20D+1.60L+0.30S	2.163	1.200	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.195
+1.20D+1.60L+0.30S	2.211	1.213	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.199
+1.20D+1.60L+0.30S	2.260	1.225	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.204
+1.20D+1.60L+0.30S	2.309	1.238	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.208
+1.20D+1.60L+0.30S	2.359	1.250	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.213
+1.20D+1.60L+0.30S	2.409	1.263	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.217
+1.20D+1.60L+0.30S	2.460	1.275	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.222
+1.20D+1.60L+0.30S	2.511	1.288	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.227
+1.20D+1.60L+0.30S	2.563	1.300	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.231
+1.20D+1.60L+0.30S	2.615	1.313	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.236
+1.20D+1.60L+0.30S	2.668	1.325	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.241
+1.20D+1.60L+0.30S	2.721	1.338	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.246
+1.20D+1.60L+0.30S	2.774	1.350	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.250
+1.20D+1.60L+0.30S	2.827	1.363	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.255
+1.20D+1.60L+0.30S	2.878	1.375	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.260
+1.20D+1.60L+0.30S	2.930	1.388	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.264
+1.20D+1.60L+0.30S	2.980	1.400	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.269
+1.20D+1.60L+0.30S	3.030	1.413	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.273
+1.20D+1.60L+0.30S	3.080	1.425	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.278
+1.20D+1.60L+0.30S	3.129	1.438	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.282
+1.20D+1.60L+0.30S	3.178	1.450	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.287
+1.20D+1.60L+0.30S	3.226	1.463	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.291
+1.20D+1.60L+0.30S	3.274	1.475	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.295
+1.20D+1.60L+0.30S	3.321	1.488	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.300
+1.20D+1.60L+0.30S	3.367	1.500	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.304
+1.20D+1.60L+0.30S	3.413	1.513	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.308
+1.20D+1.60L+0.30S	3.459	1.525	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.312
+1.20D+1.60L+0.30S	3.504	1.538	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.316
+1.20D+1.60L+0.30S	3.548	1.550	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.320
+1.20D+1.60L+0.30S	3.592	1.563	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.324
+1.20D+1.60L+0.30S	3.636	1.575	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.328
+1.20D+1.60L+0.30S	3.679	1.588	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.332
+1.20D+1.60L+0.30S	3.721	1.600	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.336
+1.20D+1.60L+0.30S	3.763	1.613	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.339
+1.20D+1.60L+0.30S	3.804	1.625	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.343
+1.20D+1.60L+0.30S	3.845	1.638	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.347

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Wall Ftg

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60L+0.30S	3.886	1.650	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.351
+1.20D+1.60L+0.30S	3.925	1.663	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.354
+1.20D+1.60L+0.30S	3.965	1.675	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.358
+1.20D+1.60L+0.30S	4.003	1.688	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.361
+1.20D+1.60L+0.30S	4.042	1.700	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.365
+1.20D+1.60L+0.30S	4.079	1.713	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.368
+1.20D+1.60L+0.30S	4.117	1.725	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.371
+1.20D+1.60L+0.30S	4.153	1.738	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.375
+1.20D+1.60L+0.30S	4.189	1.750	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.378
+1.20D+1.60L+0.30S	4.225	1.763	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.381
+1.20D+1.60L+0.30S	4.260	1.775	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.384
+1.20D+1.60L+0.30S	4.295	1.788	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.387
+1.20D+1.60L+0.30S	4.329	1.800	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.391
+1.20D+1.60L+0.30S	4.363	1.813	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.394
+1.20D+1.60L+0.30S	4.396	1.825	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.397
+1.20D+1.60L+0.30S	4.428	1.838	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.399
+1.20D+1.60L+0.30S	4.460	1.850	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.402
+1.20D+1.60L+0.30S	4.492	1.863	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.405
+1.20D+1.60L+0.30S	4.523	1.875	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.408
+1.20D+1.60L+0.30S	4.553	1.888	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.411
+1.20D+1.60L+0.30S	4.583	1.900	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.413
+1.20D+1.60L+0.30S	4.613	1.913	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.416
+1.20D+1.60L+0.30S	4.641	1.925	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.419
+1.20D+1.60L+0.30S	4.670	1.938	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.421
+1.20D+1.60L+0.30S	4.698	1.950	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.424
+1.20D+1.60L+0.30S	4.725	1.963	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.426
+1.20D+1.60L+0.30S	4.752	1.975	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.429
+1.20D+1.60L+0.30S	4.778	1.988	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.431
+1.20D+1.60L+0.30S	4.804	2.000	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.433
+1.20D+1.60L+0.30S	4.829	2.013	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.436
+1.20D+1.60L+0.30S	4.854	2.025	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.438
+1.20D+1.60L+0.30S	4.878	2.038	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.440
+1.20D+1.60L+0.30S	4.902	2.050	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.442
+1.20D+1.60L+0.30S	4.925	2.063	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.444
+1.20D+1.60L+0.30S	4.948	2.075	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.446
+1.20D+1.60L+0.30S	4.970	2.088	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.448
+1.20D+1.60L+0.30S	4.992	2.100	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.450
+1.20D+1.60L+0.30S	5.013	2.112	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.452
+1.20D+1.60L+0.30S	5.034	2.125	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.454
+1.20D+1.60L+0.30S	5.054	2.137	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.456
+1.20D+1.60L+0.30S	5.074	2.150	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.458
+1.20D+1.60L+0.30S	5.093	2.162	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.459
+1.20D+1.60L+0.30S	5.111	2.175	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.461
+1.20D+1.60L+0.30S	5.129	2.187	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.463
+1.20D+1.60L+0.30S	5.147	2.200	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.464
+1.20D+1.60L+0.30S	5.164	2.212	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.466
+1.20D+1.60L+0.30S	5.181	2.225	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.467
+1.20D+1.60L+0.30S	5.197	2.237	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.469
+1.20D+1.60L+0.30S	5.212	2.250	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.470
+1.20D+1.60L+0.30S	5.227	2.262	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.472
+1.20D+1.60L+0.30S	5.241	2.275	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.473
+1.20D+1.60L+0.30S	5.255	2.287	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.474
+1.20D+1.60L+0.30S	5.269	2.300	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.475
+1.20D+1.60L+0.30S	5.282	2.312	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.476
+1.20D+1.60L+0.30S	5.294	2.325	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.478
+1.20D+1.60L+0.30S	5.306	2.337	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.479
+1.20D+1.60L+0.30S	5.319	2.350	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.480
+1.20D+1.60L+0.30S	5.332	2.362	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.481
+1.20D+1.60L+0.30S	5.345	2.375	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.482
+1.20D+1.60L+0.30S	5.360	2.387	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.484
+1.20D+1.60L+0.30S	5.374	2.400	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.485
+1.20D+1.60L+0.30S	5.389	2.412	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.486
+1.20D+1.60L+0.30S	5.405	2.425	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.488

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Wall Ftg

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60L+0.30S	5.422	2.437	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.489
+1.20D+1.60L+0.30S	5.438	2.450	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.491
+1.20D+1.60L+0.30S	5.456	2.462	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.492
+1.20D+1.60L+0.30S	5.474	2.475	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.494
+1.20D+1.60L+0.30S	5.492	2.487	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.495
+1.20D+1.60L+0.30S	5.511	2.500	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.497
+1.20D+1.60L+0.30S	5.531	2.512	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.499
+1.20D+1.60L+0.30S	5.551	2.525	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.501
+1.20D+1.60L+0.30S	5.571	2.537	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.503
+1.20D+1.60L+0.30S	5.592	2.550	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.505
+1.20D+1.60L+0.30S	5.614	2.562	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.506
+1.20D+1.60L+0.30S	5.636	2.575	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.508
+1.20D+1.60L+0.30S	5.659	2.587	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.511
+1.20D+1.60L+0.30S	5.682	2.600	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.513
+1.20D+1.60L+0.30S	5.706	2.612	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.515
+1.20D+1.60L+0.30S	5.731	2.625	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.517
+1.20D+1.60L+0.30S	5.756	2.637	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.519
+1.20D+1.60L+0.30S	5.781	2.650	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.522
+1.20D+1.60L+0.30S	5.807	2.662	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.524
+1.20D+1.60L+0.30S	5.833	2.675	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.526
+1.20D+1.60L+0.30S	5.857	2.687	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.528
+1.20D+1.60L+0.30S	5.880	2.700	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.530
+1.20D+1.60L+0.30S	5.900	2.712	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.532
+1.20D+1.60L+0.30S	5.919	2.725	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.534
+1.20D+1.60L+0.30S	5.936	2.737	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.536
+1.20D+1.60L+0.30S	5.951	2.750	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.537
+1.20D+1.60L+0.30S	5.965	2.762	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.538
+1.20D+1.60L+0.30S	5.976	2.775	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.539
+1.20D+1.60L+0.30S	5.986	2.787	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.540
+1.20D+1.60L+0.30S	5.994	2.800	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.541
+1.20D+1.60L+0.30S	6.000	2.812	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.541
+1.20D+1.60L+0.30S	6.004	2.825	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.542
+1.20D+1.60L+0.30S	6.006	2.837	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.542
+1.20D+1.60L+0.30S	6.007	2.850	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.542
+1.20D+1.60L+0.30S	6.005	2.862	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.542
+1.20D+1.60L+0.30S	6.002	2.875	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.541
+1.20D+1.60L+0.30S	5.997	2.887	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.541
+1.20D+1.60L+0.30S	5.990	2.900	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.540
+1.20D+1.60L+0.30S	5.982	2.912	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.540
+1.20D+1.60L+0.30S	5.971	2.925	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.539
+1.20D+1.60L+0.30S	5.959	2.937	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.538
+1.20D+1.60L+0.30S	5.945	2.950	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.536
+1.20D+1.60L+0.30S	5.929	2.962	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.535
+1.20D+1.60L+0.30S	5.911	2.975	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.533
+1.20D+1.60L+0.30S	5.891	2.987	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.531
+1.20D+1.60L+0.30S	5.870	3.000	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.530
+1.20D+1.60L+0.30S	5.846	3.012	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.527
+1.20D+1.60L+0.30S	5.821	3.025	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.525
+1.20D+1.60L+0.30S	5.794	3.037	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.523
+1.20D+1.60L+0.30S	5.766	3.050	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.520
+1.20D+1.60L+0.30S	5.735	3.062	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.517
+1.20D+1.60L+0.30S	5.702	3.075	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.514
+1.20D+1.60L+0.30S	5.668	3.087	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.511
+1.20D+1.60L+0.30S	5.632	3.100	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.508
+1.20D+1.60L+0.30S	5.594	3.112	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.505
+1.20D+1.60L+0.30S	5.554	3.125	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.501
+1.20D+1.60L+0.30S	5.513	3.137	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.497
+1.20D+1.60L+0.30S	5.469	3.150	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.493
+1.20D+1.60L+0.30S	5.424	3.162	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.489
+1.20D+1.60L+0.30S	5.377	3.175	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.485
+1.20D+1.60L+0.30S	5.328	3.187	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.481
+1.20D+1.60L+0.30S	5.277	3.200	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.476
+1.20D+1.60L+0.30S	5.225	3.212	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.471

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Wall Ftg

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60L+0.30S	5.170	3.225	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.466
+1.20D+1.60L+0.30S	5.114	3.237	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.461
+1.20D+1.60L+0.30S	5.056	3.250	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.456
+1.20D+1.60L+0.30S	4.996	3.262	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.451
+1.20D+1.60L+0.30S	4.934	3.275	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.445
+1.20D+1.60L+0.30S	4.871	3.287	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.439
+1.20D+1.60L+0.30S	4.805	3.300	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.434
+1.20D+1.60L+0.30S	4.738	3.312	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.427
+1.20D+1.60L+0.30S	4.669	3.325	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.421
+1.20D+1.60L+0.30S	4.598	3.337	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.415
+1.20D+1.60L+0.30S	4.528	3.350	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.408
+1.20D+1.60L+0.30S	4.457	3.362	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.402
+1.20D+1.60L+0.30S	4.388	3.375	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.396
+1.20D+1.60L+0.30S	4.319	3.387	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.390
+1.20D+1.60L+0.30S	4.250	3.400	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.383
+1.20D+1.60L+0.30S	4.182	3.412	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.377
+1.20D+1.60L+0.30S	4.115	3.425	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.371
+1.20D+1.60L+0.30S	4.048	3.437	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.365
+1.20D+1.60L+0.30S	3.981	3.450	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.359
+1.20D+1.60L+0.30S	3.916	3.462	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.353
+1.20D+1.60L+0.30S	3.850	3.475	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.347
+1.20D+1.60L+0.30S	3.786	3.487	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.342
+1.20D+1.60L+0.30S	3.721	3.500	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.336
+1.20D+1.60L+0.30S	3.658	3.512	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.330
+1.20D+1.60L+0.30S	3.595	3.525	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.324
+1.20D+1.60L+0.30S	3.532	3.537	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.319
+1.20D+1.60L+0.30S	3.470	3.550	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.313
+1.20D+1.60L+0.30S	3.409	3.562	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.308
+1.20D+1.60L+0.30S	3.348	3.575	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.302
+1.20D+1.60L+0.30S	3.287	3.587	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.297
+1.20D+1.60L+0.30S	3.227	3.600	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.291
+1.20D+1.60L+0.30S	3.168	3.612	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.286
+1.20D+1.60L+0.30S	3.109	3.625	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.281
+1.20D+1.60L+0.30S	3.051	3.637	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.275
+1.20D+1.60L+0.30S	2.994	3.650	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.270
+1.20D+1.60L+0.30S	2.937	3.662	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.265
+1.20D+1.60L+0.30S	2.880	3.675	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.260
+1.20D+1.60L+0.30S	2.824	3.687	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.255
+1.20D+1.60L+0.30S	2.769	3.700	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.250
+1.20D+1.60L+0.30S	2.714	3.712	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.245
+1.20D+1.60L+0.30S	2.659	3.725	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.240
+1.20D+1.60L+0.30S	2.605	3.737	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.235
+1.20D+1.60L+0.30S	2.552	3.750	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.230
+1.20D+1.60L+0.30S	2.499	3.762	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.225
+1.20D+1.60L+0.30S	2.447	3.775	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.221
+1.20D+1.60L+0.30S	2.396	3.787	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.216
+1.20D+1.60L+0.30S	2.345	3.800	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.212
+1.20D+1.60L+0.30S	2.294	3.812	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.207
+1.20D+1.60L+0.30S	2.244	3.825	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.202
+1.20D+1.60L+0.30S	2.195	3.837	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.198
+1.20D+1.60L+0.30S	2.146	3.850	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.194
+1.20D+1.60L+0.30S	2.097	3.862	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.189
+1.20D+1.60L+0.30S	2.050	3.875	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.185
+1.20D+1.60L+0.30S	2.002	3.887	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.181
+1.20D+1.60L+0.30S	1.956	3.900	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.176
+1.20D+1.60L+0.30S	1.909	3.912	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.172
+1.20D+1.60L+0.30S	1.864	3.925	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.168
+1.20D+1.60L+0.30S	1.819	3.937	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.164
+1.20D+1.60L+0.30S	1.774	3.950	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.160
+1.20D+1.60L+0.30S	1.730	3.962	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.156
+1.20D+1.60L+0.30S	1.687	3.975	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.152
+1.20D+1.60L+0.30S	1.644	3.987	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.148
+1.20D+1.60L+0.30S	1.602	4.000	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.144

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Wall Ftg

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60L+0.30S	1.560	4.012	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.141
+1.20D+1.60L+0.30S	1.519	4.025	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.137
+1.20D+1.60L+0.30S	1.478	4.037	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.133
+1.20D+1.60L+0.30S	1.438	4.050	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.130
+1.20D+1.60L+0.30S	1.398	4.062	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.126
+1.20D+1.60L+0.30S	1.359	4.075	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.123
+1.20D+1.60L+0.30S	1.321	4.087	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.119
+1.20D+1.60L+0.30S	1.283	4.100	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.116
+1.20D+1.60L+0.30S	1.246	4.112	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.112
+1.20D+1.60L+0.30S	1.209	4.125	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.109
+1.20D+1.60L+0.30S	1.172	4.137	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.106
+1.20D+1.60L+0.30S	1.137	4.150	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.103
+1.20D+1.60L+0.30S	1.101	4.162	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.099
+1.20D+1.60L+0.30S	1.067	4.175	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.096
+1.20D+1.60L+0.30S	1.033	4.187	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.093
+1.20D+1.60L+0.30S	0.999	4.200	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.090
+1.20D+1.60L+0.30S	0.966	4.212	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.087
+1.20D+1.60L+0.30S	0.934	4.225	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.084
+1.20D+1.60L+0.30S	0.902	4.237	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.081
+1.20D+1.60L+0.30S	0.871	4.250	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.079
+1.20D+1.60L+0.30S	0.840	4.262	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.076
+1.20D+1.60L+0.30S	0.810	4.275	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.073
+1.20D+1.60L+0.30S	0.780	4.287	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.070
+1.20D+1.60L+0.30S	0.751	4.300	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.068
+1.20D+1.60L+0.30S	0.722	4.312	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.065
+1.20D+1.60L+0.30S	0.694	4.325	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.063
+1.20D+1.60L+0.30S	0.667	4.337	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.060
+1.20D+1.60L+0.30S	0.640	4.350	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.058
+1.20D+1.60L+0.30S	0.613	4.362	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.055
+1.20D+1.60L+0.30S	0.588	4.375	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.053
+1.20D+1.60L+0.30S	0.562	4.387	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.051
+1.20D+1.60L+0.30S	0.538	4.400	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.048
+1.20D+1.60L+0.30S	0.513	4.412	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.046
+1.20D+1.60L+0.30S	0.490	4.425	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.044
+1.20D+1.60L+0.30S	0.467	4.437	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.042
+1.20D+1.60L+0.30S	0.444	4.450	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.040
+1.20D+1.60L+0.30S	0.422	4.462	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.038
+1.20D+1.60L+0.30S	0.401	4.475	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.036
+1.20D+1.60L+0.30S	0.380	4.487	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.034
+1.20D+1.60L+0.30S	0.360	4.500	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.032
+1.20D+1.60L+0.30S	0.340	4.512	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.031
+1.20D+1.60L+0.30S	0.321	4.525	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.029
+1.20D+1.60L+0.30S	0.302	4.537	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.027
+1.20D+1.60L+0.30S	0.284	4.550	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.026
+1.20D+1.60L+0.30S	0.266	4.562	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.024
+1.20D+1.60L+0.30S	0.249	4.575	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.022
+1.20D+1.60L+0.30S	0.233	4.587	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.021
+1.20D+1.60L+0.30S	0.217	4.600	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.020
+1.20D+1.60L+0.30S	0.201	4.612	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.018
+1.20D+1.60L+0.30S	0.187	4.625	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.017
+1.20D+1.60L+0.30S	0.172	4.637	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.016
+1.20D+1.60L+0.30S	0.159	4.650	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.014
+1.20D+1.60L+0.30S	0.146	4.662	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.013
+1.20D+1.60L+0.30S	0.133	4.675	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.012
+1.20D+1.60L+0.30S	0.121	4.687	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.011
+1.20D+1.60L+0.30S	0.110	4.700	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.010
+1.20D+1.60L+0.30S	0.099	4.712	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.009
+1.20D+1.60L+0.30S	0.088	4.725	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.008
+1.20D+1.60L+0.30S	0.078	4.737	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.007
+1.20D+1.60L+0.30S	0.069	4.750	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.006
+1.20D+1.60L+0.30S	0.060	4.762	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.005
+1.20D+1.60L+0.30S	0.052	4.775	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.005
+1.20D+1.60L+0.30S	0.045	4.787	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.004

Project Title:
Engineer:
Project ID:
Project Descr:

Combined Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Wall Ftg

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60L+0.30S	0.038	4.800	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.003
+1.20D+1.60L+0.30S	0.031	4.812	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.003
+1.20D+1.60L+0.30S	0.025	4.825	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.002
+1.20D+1.60L+0.30S	0.020	4.837	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.002
+1.20D+1.60L+0.30S	0.015	4.850	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.001
+1.20D+1.60L+0.30S	0.011	4.862	Bottom	0.259	ACI 7.6.1.1	0.310	11.085	0.001
+1.20D+1.60L+0.30S	0.000	4.875	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	4.887	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	4.900	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	4.912	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	4.925	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	4.937	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	4.950	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	4.962	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	4.975	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	4.987	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60L+0.30S	0.000	5.000	0	0.000	0	0.000	0.000	0.000

One Way Shear

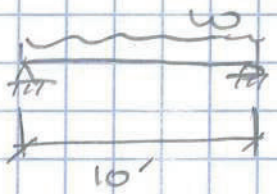
Load Combination...	Left of Column #1			Right of Column #1			Left of Column #2			Right of Column #2		
	vu (psi)	Φ vn (psi)	vu / Φ vn	vu (psi)	Φ vn (psi)	vu / Φ vn	vu (psi)	Φ vn (psi)	vu / Φ vn	vu (psi)	Φ vn (psi)	vu / Φ vn
+1.40D	20.3	48.1	0.421	9.9	48.1	0.205	29.7	48.1	0.618	5.4	48.1	0.111
+1.20D+1.60L	21.4	48.1	0.445	13.5	48.1	0.280	33.7	48.1	0.701	9.6	48.1	0.200
+1.20D+1.60L+0.30S	21.6	48.1	0.449	14.7	48.1	0.305	34.8	48.1	0.723	10.8	48.1	0.225
+1.20D+L	19.9	48.1	0.413	11.6	48.1	0.241	30.6	48.1	0.637	7.7	48.1	0.161
+1.20D	17.4	48.1	0.361	8.4	48.1	0.176	25.5	48.1	0.529	4.6	48.1	0.096
+1.20D+L+S	20.6	48.1	0.429	15.6	48.1	0.325	34.1	48.1	0.710	11.8	48.1	0.245
+1.20D+S	18.1	48.1	0.376	12.5	48.1	0.260	29.0	48.1	0.602	8.6	48.1	0.179
+1.20D+L+0.30S	20.1	48.1	0.418	12.8	48.1	0.266	31.7	48.1	0.659	8.9	48.1	0.186
+0.90D	13.0	48.1	0.271	6.3	48.1	0.132	19.1	48.1	0.397	3.4	48.1	0.072
+1.20D+L+0.150S	20.0	48.1	0.416	12.2	48.1	0.253	31.1	48.1	0.648	8.3	48.1	0.173

Two Way Shear

Load Combination...	Column #1			Column #2		
	vu (psi)	Φ vn (psi)	vu / Φ vn	vu (psi)	Φ vn (psi)	vu / Φ vn
+1.40D	0.0	0.0	0.000	0.0	0.0	0.000
+1.20D+1.60L	0.0	0.0	0.000	0.0	0.0	0.000
+1.20D+1.60L+0.30S	0.0	0.0	0.000	0.0	0.0	0.000
+1.20D+L	0.0	0.0	0.000	0.0	0.0	0.000
+1.20D	0.0	0.0	0.000	0.0	0.0	0.000
+1.20D+L+S	0.0	0.0	0.000	0.0	0.0	0.000
+1.20D+S	0.0	0.0	0.000	0.0	0.0	0.000
+1.20D+L+0.30S	0.0	0.0	0.000	0.0	0.0	0.000
+0.90D	0.0	0.0	0.000	0.0	0.0	0.000
+1.20D+L+0.150S	0.0	0.0	0.000	0.0	0.0	0.000

DESIGN MEZZANINE

FLOOR FRAMING



$w_D = 1.33'(15\ PSF) = 20\ PLF$

$w_L = 1.33'(100\ PSF) = 133\ PLF$

$w = 153\ PLF$

$M_{max} = \frac{wl^2}{8} = 1913\#\text{-ft} = 23\ in\text{-k}$

$V_{max} = \frac{wl}{2} = 765\#$

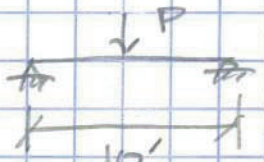
For $\Delta_L \leq \frac{L}{360}$, $I_{req} = \frac{360(5)w_L L^3}{384E}$

$= 3.6\ in^4$

USE 800S162-54 MIN @ 16" O.C.

$M_{AD} = 32.8\ in\text{-k}$, $I_x = 5.6\ in^4$, $V_{anet} = 2.1\ k$

DOUBLE UP STUDS UNDER SHIPS LADDER



$P_D = 500\#$

$P_L = 1k$

$M_{max} = \frac{PL}{4} = 3.75\ k\text{-ft} = 45\ in\text{-k}$

$V_{max} = P = 1.5k$

For $\Delta_{TL} \leq \frac{L}{240}$, $I_{req} = \frac{240PL^2}{48E}$

$= 3.7\ in^4$

USE (2) 800S162-54 MIN

$M_{AD} = (2)32.8\ in\text{-k} = 65\ in\text{-k} > M_{max}$

$V_{anet} = (2)765\# = 1530\# > V_{max}$, OK.

$I_x = 2(3.6\ in^4) = 7.2\ in^4 > I_{req}$, OK.

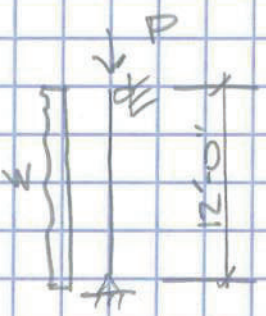
Member	Design Thickness (in)	Fy (KSI)	Fya (KSI)	Gross							Effective Properties						Torsional Properties						Lu (in)
				Area (in^2)	Weight (lb/ft)	Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ix (in^4)	Sx (in^3)	Ma (in-k)	Mad (in-k)	Vag (lb)	Vanet (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	Beta	
550S162-33	0.0346	33	33.0	0.327	1.11	1.458	0.530	2.112	0.113	0.589	1.458	0.512	10.11	8.63	699	699	0.130	0.713	-1.114	0.697	2.459	0.795	41.4
550S162-43	0.0451	33	36.3	0.424	1.44	1.883	0.685	2.107	0.145	0.584	1.883	0.681	14.79*	13.14	1550	1199	0.288	0.905	-1.103	0.691	2.448	0.797	39.2
550S162-54	0.0566	50	55.3	0.528	1.80	2.324	0.845	2.098	0.176	0.577	2.324	0.811	26.86*	23.52	3093	1881	0.564	1.105	-1.090	0.684	2.434	0.800	31.6
550S162-68	0.0713	50	56.6	0.657	2.24	2.861	1.040	2.086	0.212	0.568	2.861	1.031	34.94*	32.28	5350	2532	1.114	1.342	-1.072	0.675	2.414	0.803	31.1
550S162-97	0.1017	50	59.2	0.915	3.11	3.886	1.413	2.061	0.276	0.549	3.886	1.413	49.41	49.41	9518	3026	3.154	1.775	-1.037	0.656	2.372	0.809	30.0
550S200-33	0.0346	33	33.0	0.362	1.23	1.694	0.616	2.164	0.204	0.751	1.694	0.559	11.05	9.80	699	699	0.144	1.326	-1.508	0.925	2.742	0.698	42.1
550S200-43	0.0451	33	33.0	0.469	1.60	2.189	0.796	2.159	0.261	0.746	2.189	0.776	15.34	13.96	1550	1199	0.163	1.691	-1.496	0.918	2.731	0.700	51.7
550S200-54	0.0566	50	50.0	0.585	1.99	2.706	0.984	2.152	0.320	0.739	2.706	0.901	26.98	24.85	3093	1881	0.624	2.072	-1.483	0.911	2.716	0.702	41.8
550S200-68	0.0713	50	55.4	0.729	2.48	3.341	1.215	2.141	0.389	0.731	3.341	1.170	38.83	35.92	5350	2532	1.235	2.531	-1.465	0.902	2.695	0.705	39.6
550S200-97	0.1017	50	57.6	1.016	3.46	4.563	1.659	2.119	0.516	0.712	4.563	1.659	57.25	57.25	9518	3026	3.504	3.384	-1.428	0.882	2.652	0.710	38.6
600S137-33	0.0346	33	33.0	0.318	1.08	1.582	0.527	2.229	0.069	0.464	1.548	0.455	8.98	8.19	638	638	0.127	0.500	-0.807	0.519	2.416	0.889	33.5
600S137-43	0.0451	33	33.0	0.413	1.41	2.042	0.681	2.223	0.087	0.459	2.041	0.645	12.74	11.82	1416	1240	0.280	0.633	-0.796	0.513	2.406	0.890	33.2
600S137-54	0.0566	50	50.0	0.514	1.75	2.518	0.839	2.213	0.105	0.452	2.518	0.777	23.26	21.24	2823	1947	0.549	0.769	-0.784	0.506	2.391	0.893	26.8
600S137-68	0.0713	50	50.0	0.640	2.18	3.094	1.031	2.200	0.125	0.443	3.094	1.030	30.84	28.89	5350	2879	1.084	0.930	-0.768	0.497	2.371	0.895	26.5
600S137-97	0.1017	50	60.8	0.889	3.03	4.188	1.396	2.170	0.159	0.422	4.188	1.396	50.80*	50.80	10472	3805	3.066	1.216	-0.734	0.480	2.330	0.901	23.6
600S162-33	0.0346	33	33.0	0.344	1.17	1.793	0.598	2.282	0.116	0.581	1.793	0.577	11.41	9.47	638	638	0.137	0.861	-1.072	0.677	2.587	0.828	41.1
600S162-43	0.0451	33	36.3	0.447	1.52	2.316	0.772	2.276	0.148	0.576	2.316	0.767	16.68*	14.46	1416	1240	0.303	1.095	-1.062	0.670	2.577	0.830	39.0
600S162-54	0.0566	50	55.3	0.556	1.89	2.860	0.953	2.267	0.180	0.570	2.860	0.916	30.33*	25.90	2823	1947	0.594	1.337	-1.049	0.663	2.562	0.832	31.4
600S162-68	0.0713	50	56.6	0.693	2.36	3.525	1.175	2.255	0.218	0.560	3.525	1.164	39.47*	35.70	5350	2879	1.174	1.626	-1.032	0.655	2.543	0.835	30.8
600S162-97	0.1017	50	59.2	0.966	3.29	4.797	1.599	2.229	0.283	0.541	4.797	1.599	56.73*	56.73	10472	3805	3.329	2.153	-0.997	0.636	2.501	0.841	29.8
600S162-118	0.1242	50	61.1	1.158	3.94	5.652	1.884	2.209	0.321	0.526	5.652	1.884	68.94	68.94	12526	3622	5.956	2.487	-0.971	0.623	2.470	0.845	29.1
600S200-33	0.0346	33	33.0	0.379	1.29	2.075	0.692	2.340	0.209	0.743	2.058	0.621	12.28	10.76	638	638	0.151	1.593	-1.457	0.901	2.855	0.740	51.6
600S200-43	0.0451	33	33.0	0.492	1.67	2.683	0.894	2.335	0.268	0.739	2.683	0.873	17.24	15.39	1416	1240	0.334	2.033	-1.446	0.894	2.844	0.742	51.5
600S200-54	0.0566	50	50.0	0.613	2.09	3.319	1.106	2.327	0.328	0.732	3.319	1.015	30.40	27.38	2823	1947	0.655	2.493	-1.432	0.887	2.829	0.744	41.6
600S200-68	0.0713	50	55.4	0.764	2.60	4.101	1.367	2.316	0.400	0.723	4.101	1.317	43.71*	39.69	5350	2879	1.295	3.047	-1.415	0.878	2.809	0.746	39.3
600S200-97	0.1017	50	57.6	1.067	3.63	5.612	1.871	2.293	0.530	0.705	5.612	1.871	64.53*	63.67	10472	3805	3.679	4.080	-1.378	0.859	2.767	0.752	38.3
600S200-118	0.1242	50	59.2	1.283	4.36	6.641	2.214	2.276	0.611	0.690	6.641	2.214	78.44	78.44	12526	3622	6.595	4.753	-1.351	0.845	2.735	0.756	37.6
600S250-43	0.0451	33	33.0	0.537	1.83	3.082	1.027	2.396	0.458	0.923	3.082	0.918	18.14	16.21	1416	1240	0.364	3.411	-1.874	1.136	3.179	0.652	62.4
600S250-54	0.0566	50	50.0	0.670	2.28	3.819	1.273	2.388	0.562	0.917	3.766	1.069	32.00	28.71	2823	1947	0.715	4.194	-1.860	1.129	3.163	0.654	50.5
600S250-68	0.0713	50	50.0	0.836	2.84	4.727	1.576	2.378	0.688	0.908	4.723	1.386	41.49	39.07	5350	2879	1.416	5.145	-1.842	1.119	3.142	0.656	50.4
600S250-97	0.1017	50	56.2	1.169	3.98	6.496	2.165	2.357	0.923	0.889	6.496	2.063	69.38*	66.81	10472	3805	4.030	6.947	-1.803	1.100	3.098	0.661	47.3
600S250-118	0.1242	50	57.4	1.407	4.79	7.713	2.571	2.342	1.075	0.874	7.713	2.498	85.92	86.83	12526	3622	7.234	8.142	-1.775	1.085	3.066	0.665	46.6
600S300-54	0.0566	50	50.0	0.754	2.57	4.462	1.487	2.432	0.986	1.143	4.332	1.277	38.23	33.68	2823	1947	0.806	8.115	-2.483	1.481	3.659	0.539	59.1
600S300-68	0.0713	50	50.0	0.943	3.21	5.534	1.845	2.423	1.214	1.135	5.534	1.610	48.20	45.90	5350	2879	1.597	9.992	-2.465	1.471	3.638	0.541	59.0
600S300-97	0.1017	50	50.0	1.321	4.50	7.639	2.546	2.404	1.649	1.117	7.639	2.442	73.11	72.75	10472	3805	4.556	13.587	-2.427	1.451	3.594	0.544	58.8
600S300-118	0.1242	50	56.3	1.593	5.42	9.100	3.033	2.390	1.940	1.104	9.100	2.939	99.02	99.47	12526	3622	8.1914	16.0127	-2.398	1.437	3.561	0.546	55.3
600S350-54	0.0566	50	50.0	0.825	2.81	5.023	1.674	2.467	1.491	1.344	4.774	1.335	39.97	36.56	2823	1947	0.8812	12.9421	-3.037	1.787	4.137	0.461	74.4
600S350-68	0.0713	50	50.0	1.032	3.51	6.237	2.079	2.459	1.841	1.336	6.207	1.771	53.01	49.70	5350	2879	1.7483	15.9678	-3.018	1.777	4.115	0.462	74.3
600S350-97	0.1017	50	50.0	1.449	4.93	8.631	2.877	2.441	2.518	1.318	8.631	2.593	77.64	78.36	10472	3805	4.9943	21.811	-2.979	1.757	4.071	0.464	74.3
600S350-118	0.1242	50	55.4	1.748	5.95	10.304	3.435	2.428	2.978	1.305	10.304	3.268	108.43	107.66	12526	3622	8.9897	25.7905	-2.951	1.742	4.038	0.466	70.6
800S137-33[1]	0.0346	33	33.0	0.388	1.32	3.198	0.799	2.873	0.073	0.435	2.998	0.622	12.3	10.71	474	474	0.155	0.957	-0.696	0.460	2.987	0.946	32.5
800S137-43	0.0451	33	33.0	0.503	1.71	4.134	1.033	2.866	0.093	0.430	4.001	0.896	17.7	15.78	1051	1051	0.341	1.214	-0.687	0.454	2.978	0.947	32.2
800S137-54	0.0566	50	50.0	0.627	2.13	5.110	1.277	2.855	0.112	0.423	4.974	1.083	32.42	28.47	2091	2091	0.670	1.478	-0.676	0.448	2.964	0.948	25.9
800S137-68	0.0713	50	50.0	0.782	2.66	6.303	1.576	2.839	0.134	0.414	6.285	1.468	43.96	39.57	4221	3367	1.325	1.789	-0.661	0.440	2.944	0.950	25.6
800S137-97	0.1017	50	50.0	1.093	3.72	8.597	2.149	2.805	0.169	0.394	8.597	2.149	64.35	63.91	10885	5938	3.767	2.349	-0.630	0.423	2.902	0.953	25.0
800S162-33[1]	0.0346	33	33.0	0.413	1.41	3.582	0.896	2.943	0.125	0.550	3.384	0.710	14.03	12.61	474	474	0.165	1.630	-0.936	0.607	3.137	0.911	40.1
800S162-43	0.0451	33	33.0	0.537	1.83	4.633	1.158	2.937	0.160	0.546	4.500	1.019	20.14	18.33	1051	1051	0.364	2.076	-0.926	0.601	3.128	0.912	39.9
800S162-54	0.0566	50	50.0	0.670	2.28	5.736	1.434	2.927	0.194	0.539	5.600	1.229	36.79	32.81	2091	2091	0.715	2.539	-0.914	0.594	3.113	0.914	32.1
800S162-68	0.0713	50	50.0	0.836	2.84	7.089	1.772	2.913	0.235	0.530	7.070	1.663	49.8	45.11	4221	3367	1.416	3.093	-0.899	0.586	3.094	0.916	31.9
800S162-97	0.1017	50	50.0	1.169	3.98	9.713	2.428	2.883	0.305	0.510	9.713	2.428	72.7	71.94	10885	5938	4.030	4.114	-0.866	0.568	3.053	0.919	31.4
800S162-118	0.1242	50	61.1	1.407	4.79	11.504	2.876	2.860	0.346	0.496	11.504	2.876	105.2268	105.23	16235	7115	7.234	4.766	-0.842	0.556	3.022	0.922	28.0
800S200-33[1]	0.0346	33	33.0	0.448	1.52	4.096	1.024	3.023	0.227	0.712	4.096	0.816	16.12	14.52	474	474	0.179	2.971	-1.288	0.817	3.363	0.853	50.5
800S200-43	0.0451	33	33.0	0.582	1.98	5.302	1.325	3.018	0.292	0.708	5.302	1.293	25.54	20.99	1051	1051	0.395	3.797	-1.277	0.811	3.353	0.855	50.4
800S200-54	0.0566	50	50.0	0.726	2.47	6.573	1.643	3.009	0.357	0.701	6.573	1.499	44.87	37.37	2091	2091	0.775	4.663	-1.265	0.804	3.338	0.856	40.7
800S200-68	0.0713	50	55.4	0.907	3.09	8.140	2.035	2.996	0.435	0.692	8.140	1.964	65.21*	54.70	4221	3367	1.537	5.712	-1.248	0.796	3.319	0.859	38.4
800S200-97	0.1017	50	57.6	1.271	4.32	11.203	2.801	2.969	0.576	0.673	11.203	2.801	96.63*	89.76	10885	5938	4.381	7.684	-1.214	0.777	3.278	0.863	37.2
800S200-118	0.1242	50	59.2	1.531	5.21	13.316	3.329	2.949	0.665	0.659	13.316	3.329	117.9528	117.55	16235	7115	7.872	8.981	-1.188	0.764	3.247	0.866	36.5
800S250-43	0.0451	33	33.0	0.627	2.13	6.015	1.504	3.097	0.500	0.893	6.015	1.313	25.95	22.06	1051	1051	0.425	6.374	-1.675	1.043	3.632	0.787	61.5
800S250-54	0.0566	50	50.0	0.783	2.66	7.465	1.866	3.088	0.614	0.886	7.378	1.525	45.66	39.13	2091	2091	0.836	7.850	-1.661	1.036	3.617	0.789	49.8
800S250-68	0.0713	50	50.0	0.978	3.33	9.261	2.315	3.077	0.752	0.877	9.240	2.059	61.65	53.75	4221	3367	1.658	9.652	-1.644	1.027	3.597	0.791	49.6
800S250-97	0.1017	50	56.2	1.372	4.67	12.789	3.197	3.053	1.009	0.857	12.789	3.054	102.70*	93.42	10885	5938	4.731	13.091	-1.607	1.008	3.555	0.796	46.4
800S250-118	0.1242	50	57.4	1.655	5.63	15.242	3.810	3.035	1.175	0.843	15.242	3.707	127.5072	122.92	16235	7115	8.511	15.395	-1.580	0.994	3.524	0.799	45.6
800S300-54	0.0566	50	50.0	0.868	2.95	8.657	2.164	3.159	1.085	1.118	8.443	1.826	54.66	45.96	2091	2091	0.927	14.642	-2.244	1.372	4.033	0.690	58.6
800S300-68	0.0713	50	50.0	1.085	3.69	10.758	2.690	3.149	1.336	1.110	10.758	2.371	70.98	63.08	4221	3367	1.839	18.066	-2.226	1.363	4.012	0.692	58.4
800S300-97	0.1017	50	50.0	1.525	5.19	14.913	3.728	3.127	1.817	1.092	14.913	3.576	107.05	101.38	10885	5938	5.257	24.677	-2.188	1.343	3.970	0.696	58.1
800S300-118	0.1242	50	56.3	1.842	6.27	17.824	4.456	3.111	2.139	1.078	17.824	4.316	145.434	139.91	16235	7115	9.469	29.179	-2.161	1.329	3.938	0.699	54.5
800S350-54	0.0566	50	50.0	0.938	3.19	9.683	2.421	3.212	1.646	1.325	9.310	1.869	55.9632	49.74	2091	2091	1.002	22.897	-2.766	1.668	4.441	0.612	73.0
800S350-68	0.0713	50	50.0	1.174	4.00	12.046	3.012	3.203	2.034	1.316	12.046	2.596	77.7324	68.05	4221	3367	1.990	28.308	-2.748	1.658	4.421	0.614	72.9
800S350-97	0.1017	50	50.0	1.652	5.62	16.737	4.184	3.183	2.784	1.298	16.737	3.786	113.3388	108.67	10885	5938	5.696	38.834	-2.710	1.639	4.377	0.617	72.7
800S350-118	0.1242	50	55.4	1.997	6.79	20.041	5.010	3.168	3.295	1.285	20.041	4.762	158.0208	150.37	16235	7115	10.267	46.068	-2.682	1.624	4.345	0.619	68.9

Notes:

1. Web-height to thickness ratio exceeds 200. Web Stiffeners are required at all support points and concentrated loads.

*Where Ma is noted with an asterisk, cold-work of forming is applicable and has been used.

DESIGN STUDS



$W_L = 1.33'(5\ PSF) = 6.7\ PLF$

UNDER TYP JOIST

$P_D = 1.33'(5')\ 15\ PSF = 100\#$

$P_L = 1.33(5')(100\ PSF) = 665\#$

$\Sigma P = 765\#$

UNDER JOISTS SUPPORTING SHIPS LADDER

$P_D = 500\#$

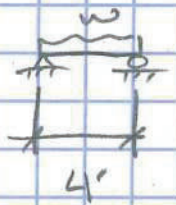
$P_L = 1K$

$\Sigma = 1.5K$

USE 362S162-43 MIN @ 16" o.c.

$P_{ALLOW} = 1.72K > \Sigma P$, O.K.

DESIGN OPNG HDR



$W_D = 6'(15\ PSF) = 90\ PLF$

$W_L = 6'(100\ PSF) = 600\ PLF$

$M_{MAX} = \frac{wL^2}{8} = 1380\#\text{-}ft = 16.6\ K\text{-}in$

USE (2)600S162-43 MIN

$M_{ALLOW} = 2(14.46\ K\text{-}in) = 28.9\ K\text{-}in$

$> M_{MAX}$, OK.

Allowable Combined Axial and Bending Loads 5psf Lateral Load

Wall	Spacing	600S137-mils (Fy)					600S162-mils (Fy)					
Ht. (ft)	(in) o.c.	-33 (33)	-43 (33)	-54 (50)	-68 (50)	-97 (50)	-33 (33)	-43 (33)	-54 (50)	-68 (50)	-97 (50)	-118 (50)
8	12	1.77 [6]	2.51 [6]	3.81 [6]	5.05 [6]	7.54 [6]	2.42 [6]	3.40 [6]	5.61 [6]	7.45 [6]	11.39 [6]	14.23 [6]
	16	1.73 [6]	2.47 [6]	3.78 [6]	5.02 [6]	7.52 [6]	2.37 [6]	3.35 [6]	5.57 [6]	7.41 [6]	11.35 [6]	14.19 [6]
	24	1.65 [6]	2.39 [6]	3.72 [6]	4.96 [6]	7.46 [6]	2.28 [6]	3.27 [6]	5.49 [6]	7.33 [6]	11.28 [6]	14.11 [6]
9	12	1.74 [6]	2.47 [6]	3.78 [6]	5.02 [6]	7.52 [6]	2.38 [6]	3.36 [6]	5.57 [6]	7.41 [6]	11.35 [6]	14.19 [6]
	16	1.69 [6]	2.43 [6]	3.74 [6]	4.98 [6]	7.48 [6]	2.32 [6]	3.30 [6]	5.52 [6]	7.36 [6]	11.31 [6]	14.14 [6]
	24	1.59 [6]	2.33 [6]	3.66 [6]	4.90 [6]	7.41 [6]	2.20 [6]	3.19 [6]	5.42 [6]	7.26 [6]	11.21 [6]	14.03 [6]
10	12	1.70 [6]	2.44 [6]	3.75 [6]	4.99 [6]	7.49 [6]	2.33 [6]	3.31 [6]	5.53 [6]	7.37 [6]	11.31 [6]	14.14 [6]
	16	1.63 [6]	2.37 [6]	3.70 [6]	4.94 [6]	7.44 [6]	2.25 [6]	3.24 [6]	5.46 [6]	7.30 [6]	11.25 [6]	14.07 [6]
	24	1.51 [6]	2.25 [6]	3.59 [6]	4.83 [6]	7.36 [6]	2.10 [6]	3.11 [6]	5.33 [6]	7.17 [6]	11.12 [6]	14.39 [6]
12	12	1.60 [6]	2.34 [6]	3.66 [6]	4.90 [6]	7.41 [6]	2.17 [6]	3.15 [6]	5.35 [6]	7.25 [6]	11.19 [6]	14.01 [6]
	16	1.51 [6]	2.25 [6]	3.59 [6]	4.82 [6]	7.34 [6]	2.06 [6]	3.05 [6]	5.25 [6]	7.15 [6]	11.09 [6]	13.90 [6]
	24	1.33 [6]	2.07 [6]	3.43 [6]	4.67 [6]	7.21 [6]	1.85 [6]	2.85 [6]	5.05 [6]	6.95 [6]	10.89 [6]	13.69 [6]
14	12	1.48 [6]	2.22 [6]	3.55 [6]	4.79 [6]	7.31 [6]	1.95 [6]	2.91 [6]	4.93 [6]	6.77 [6]	10.96 [6]	13.81 [6]
	16	1.36 [6]	2.09 [6]	3.44 [6]	4.67 [6]	7.20 [6]	1.81 [6]	2.78 [6]	4.80 [6]	6.63 [6]	10.80 [6]	13.64 [6]
	24	1.11 [6]	1.85 [6]	3.21 [6]	4.45 [6]	7.00 [6]	1.54 [6]	2.51 [6]	4.53 [6]	6.35 [6]	10.49 [6]	13.30 [6]
16	12	1.34 [6]	2.07 [6]	3.40 [6]	4.63 [6]	7.15 [6]	1.71 [6]	2.62 [6]	4.41 [6]	6.10 [6]	9.89 [6]	10.05 [6]
	16	1.18 [6]	1.90 [6]	3.24 [6]	4.46 [6]	7.00 [6]	1.53 [6]	2.45 [6]	4.24 [6]	5.91 [6]	9.68 [6]	9.95 [6]
	24	0.87 [4]	1.59 [6]	2.95 [6]	4.16 [6]	6.71 [6]	1.20 [5]	2.12 [6]	3.91 [6]	5.57 [6]	9.28 [6]	9.76 [6]

Wall	Spacing	600S200-mils (Fy)						600S250-mils (Fy)				
Ht. (ft)	(in) o.c.	-33 (33)	-43 (33)	-54 (50)	-68 (50)	-97 (50)	-118 (50)	-43 (33)	-54 (50)	-68 (50)	-97 (50)	-118 (50)
8	12	2.86 [6]	4.31 [6]	7.46 [6]	9.97 [6]	15.65 [6]	20.05 [6]	4.65 [6]	7.64 [6]	11.05 [6]	18.28 [6]	23.36 [6]
	16	2.81 [6]	4.26 [6]	7.41 [6]	9.93 [6]	15.60 [6]	19.20 [6]	4.60 [6]	7.59 [6]	11.00 [6]	18.22 [6]	23.30 [6]
	24	2.72 [6]	4.16 [6]	7.31 [6]	9.83 [6]	15.51 [6]	19.90 [6]	4.50 [6]	7.50 [6]	10.90 [6]	18.12 [6]	23.20 [6]
9	12	2.80 [6]	4.23 [6]	7.31 [6]	9.79 [6]	15.39 [6]	19.83 [6]	4.57 [6]	7.51 [6]	10.85 [6]	17.92 [6]	22.90 [6]
	16	2.74 [6]	4.16 [6]	7.25 [6]	9.73 [6]	15.33 [6]	19.76 [6]	4.50 [6]	7.44 [6]	10.78 [6]	17.85 [6]	22.83 [6]
	24	2.62 [6]	4.03 [6]	7.12 [6]	9.61 [6]	15.20 [6]	19.63 [6]	4.37 [6]	7.32 [6]	10.64 [6]	17.72 [6]	22.69 [6]
10	12	2.73 [6]	4.13 [6]	7.14 [6]	9.58 [6]	15.07 [6]	19.41 [6]	4.47 [6]	7.35 [6]	10.60 [6]	17.49 [6]	22.36 [6]
	16	2.65 [6]	4.05 [6]	7.05 [6]	9.50 [6]	14.99 [6]	19.32 [6]	4.39 [6]	7.27 [6]	10.52 [6]	17.40 [6]	22.27 [6]
	24	2.50 [6]	3.88 [6]	6.89 [6]	9.35 [6]	14.83 [6]	19.15 [6]	4.23 [6]	7.11 [6]	10.35 [6]	17.23 [6]	22.09 [6]
12	12	2.55 [6]	3.88 [6]	6.67 [6]	9.00 [6]	14.21 [6]	18.29 [6]	4.24 [6]	6.94 [6]	10.00 [6]	16.41 [6]	20.98 [6]
	16	2.44 [6]	3.76 [6]	6.55 [6]	8.89 [6]	14.09 [6]	18.16 [6]	4.11 [6]	6.82 [6]	9.87 [6]	16.28 [6]	20.84 [6]
	24	2.22 [6]	3.53 [6]	6.31 [6]	8.66 [6]	13.85 [6]	17.90 [6]	3.88 [6]	6.59 [6]	9.62 [6]	16.02 [6]	20.57 [6]
14	12	2.32 [6]	3.56 [6]	6.07 [6]	8.26 [6]	13.08 [6]	16.81 [6]	3.94 [6]	6.46 [6]	9.26 [6]	15.07 [6]	19.26 [6]
	16	2.17 [6]	3.40 [6]	5.91 [6]	8.10 [6]	12.91 [6]	16.62 [6]	3.77 [6]	6.29 [6]	9.08 [6]	14.88 [6]	19.07 [6]
	24	1.89 [6]	3.09 [6]	5.59 [6]	7.79 [6]	12.58 [6]	16.25 [6]	3.45 [6]	5.98 [6]	8.73 [6]	14.52 [6]	18.69 [6]
16	12	2.05 [6]	3.18 [6]	5.38 [6]	7.38 [6]	11.74 [6]	15.06 [6]	3.59 [6]	5.96 [6]	8.44 [6]	13.53 [6]	17.30 [6]
	16	1.87 [6]	2.98 [6]	5.18 [6]	7.17 [6]	11.52 [6]	14.81 [6]	3.38 [6]	5.75 [6]	8.21 [6]	13.29 [6]	17.04 [6]
	24	1.52 [6]	2.61 [6]	4.79 [6]	6.79 [6]	11.09 [6]	14.33 [6]	2.98 [6]	5.34 [6]	7.76 [6]	12.82 [6]	16.54 [6]

Wall	Spacing	600S300-mils (Fy)				600S350-mils (Fy)			
Ht. (ft)	(in) o.c.	-54 (50)	-68 (50)	-97 (50)	-118 (50)	-54 (50)	-68 (50)	-97 (50)	-118 (50)
8	12	7.40 [6]	11.19 [6]	19.51 [6]	25.34 [6]	10.24 [6]	14.72 [6]	24.02 [6]	31.79 [6]
	16	7.89 [6]	11.11 [6]	19.45 [6]	25.29 [6]	10.18 [6]	14.72 [6]	23.96 [6]	31.73 [6]
	24	7.79 [6]	11.04 [6]	19.34 [6]	25.18 [6]	10.08 [6]	14.61 [6]	23.84 [6]	31.62 [6]
9	12	7.80 [6]	11.00 [6]	19.12 [6]	24.86 [6]	10.04 [6]	14.51 [6]	23.57 [6]	31.04 [6]
	16	7.73 [6]	10.93 [6]	19.04 [6]	24.79 [6]	9.97 [6]	14.44 [6]	23.49 [6]	30.96 [6]
	24	7.61 [6]	10.80 [6]	18.89 [6]	24.65 [6]	9.84 [6]	14.29 [6]	23.34 [6]	30.82 [6]
10	12	7.63 [6]	10.77 [6]	18.66 [6]	24.31 [6]	9.81 [6]	14.20 [6]	23.07 [6]	30.19 [6]
	16	7.55 [6]	10.69 [6]	18.56 [6]	24.22 [6]	9.72 [6]	14.11 [6]	22.97 [6]	30.09 [6]
	24	7.39 [6]	10.52 [6]	18.38 [6]	24.04 [6]	9.56 [6]	13.93 [6]	22.77 [6]	29.90 [6]
12	12	7.22 [6]	10.24 [6]	17.55 [6]	22.99 [6]	9.26 [6]	13.46 [6]	21.91 [6]	28.18 [6]
	16	7.10 [6]	10.12 [6]	17.41 [6]	22.85 [6]	9.14 [6]	13.32 [6]	21.76 [6]	28.04 [6]
	24	6.88 [6]	9.88 [6]	17.13 [6]	22.58 [6]	8.89 [6]	13.05 [6]	21.46 [6]	27.75 [6]
14	12	6.71 [6]	9.62 [6]	16.23 [6]	21.48 [6]	8.60 [6]	12.56 [6]	20.42 [6]	25.85 [6]
	16	6.56 [6]	9.45 [6]	16.02 [6]	21.28 [6]	8.43 [6]	12.36 [6]	20.20 [6]	25.64 [6]
	24	6.25 [6]	9.11 [6]	15.63 [6]	20.88 [6]	8.10 [6]	11.99 [6]	19.77 [6]	25.23 [6]
16	12	6.13 [6]	8.89 [6]	14.77 [6]	19.47 [6]	7.86 [6]	11.52 [6]	18.35 [6]	23.27 [6]
	16	5.93 [6]	8.66 [6]	14.50 [6]	19.20 [6]	7.64 [6]	11.27 [6]	18.06 [6]	22.99 [6]
	24	5.54 [6]	8.22 [6]	13.99 [6]	18.67 [6]	7.22 [6]	10.77 [6]	17.50 [6]	22.45 [6]

Notes:

- [1] Deflection meets L/120
- [2] Deflection meets L/240
- [3] Deflection meets L/360
- [4] Deflection meets L/480
- [5] Deflection meets L/600
- [6] Deflection meets L/720
- Axial Load Multiplier = 1
- KyLy & KtLt = 48
- Lateral Load Multiplier - Strength = 1
- Lateral Load Multiplier - Deflection = 1.0
- * h/t > 200, stiffeners are required at supports

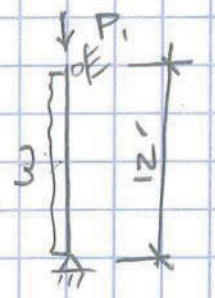
Member	Design Thickness (in)	Fy (KSI)	Fya (KSI)	Gross							Effective Properties						Torsional Properties						Lu (in)
				Area (in^2)	Weight (lb/ft)	Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ix (in^4)	Sx (in^3)	Ma (in-k)	Mad (in-k)	Vag (lb)	Vanet (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	Beta	
550S162-33	0.0346	33	33.0	0.327	1.11	1.458	0.530	2.112	0.113	0.589	1.458	0.512	10.11	8.63	699	699	0.130	0.713	-1.114	0.697	2.459	0.795	41.4
550S162-43	0.0451	33	36.3	0.424	1.44	1.883	0.685	2.107	0.145	0.584	1.883	0.681	14.79*	13.14	1550	1199	0.288	0.905	-1.103	0.691	2.448	0.797	39.2
550S162-54	0.0566	50	55.3	0.528	1.80	2.324	0.845	2.098	0.176	0.577	2.324	0.811	26.86*	23.52	3093	1881	0.564	1.105	-1.090	0.684	2.434	0.800	31.6
550S162-68	0.0713	50	56.6	0.657	2.24	2.861	1.040	2.086	0.212	0.568	2.861	1.031	34.94*	32.28	5350	2532	1.114	1.342	-1.072	0.675	2.414	0.803	31.1
550S162-97	0.1017	50	59.2	0.915	3.11	3.886	1.413	2.061	0.276	0.549	3.886	1.413	49.41	49.41	9518	3026	3.154	1.775	-1.037	0.656	2.372	0.809	30.0
550S200-33	0.0346	33	33.0	0.362	1.23	1.694	0.616	2.164	0.204	0.751	1.694	0.559	11.05	9.80	699	699	0.144	1.326	-1.508	0.925	2.742	0.698	42.1
550S200-43	0.0451	33	33.0	0.469	1.60	2.189	0.796	2.159	0.261	0.746	2.189	0.776	15.34	13.96	1550	1199	0.163	1.691	-1.496	0.918	2.731	0.700	51.7
550S200-54	0.0566	50	50.0	0.585	1.99	2.706	0.984	2.152	0.320	0.739	2.706	0.901	26.98	24.85	3093	1881	0.624	2.072	-1.483	0.911	2.716	0.702	41.8
550S200-68	0.0713	50	55.4	0.729	2.48	3.341	1.215	2.141	0.389	0.731	3.341	1.170	38.83	35.92	5350	2532	1.235	2.531	-1.465	0.902	2.695	0.705	39.6
550S200-97	0.1017	50	57.6	1.016	3.46	4.563	1.659	2.119	0.516	0.712	4.563	1.659	57.25	57.25	9518	3026	3.504	3.384	-1.428	0.882	2.652	0.710	38.6
600S137-33	0.0346	33	33.0	0.318	1.08	1.582	0.527	2.229	0.069	0.464	1.548	0.455	8.98	8.19	638	638	0.127	0.500	-0.807	0.519	2.416	0.889	33.5
600S137-43	0.0451	33	33.0	0.413	1.41	2.042	0.681	2.223	0.087	0.459	2.041	0.645	12.74	11.82	1416	1240	0.280	0.633	-0.796	0.513	2.406	0.890	33.2
600S137-54	0.0566	50	50.0	0.514	1.75	2.518	0.839	2.213	0.105	0.452	2.518	0.777	23.26	21.24	2823	1947	0.549	0.769	-0.784	0.506	2.391	0.893	26.8
600S137-68	0.0713	50	50.0	0.640	2.18	3.094	1.031	2.200	0.125	0.443	3.094	1.030	30.84	28.89	5350	2879	1.084	0.930	-0.768	0.497	2.371	0.895	26.5
600S137-97	0.1017	50	60.8	0.889	3.03	4.188	1.396	2.170	0.159	0.422	4.188	1.396	50.80*	50.80	10472	3805	3.066	1.216	-0.734	0.480	2.330	0.901	23.6
600S162-33	0.0346	33	33.0	0.344	1.17	1.793	0.598	2.282	0.116	0.581	1.793	0.577	11.41	9.47	638	638	0.137	0.861	-1.072	0.677	2.587	0.828	41.1
600S162-43	0.0451	33	36.3	0.447	1.52	2.316	0.772	2.276	0.148	0.576	2.316	0.767	16.68*	14.46	1416	1240	0.303	1.095	-1.062	0.670	2.577	0.830	39.0
600S162-54	0.0566	50	55.3	0.556	1.89	2.860	0.953	2.267	0.180	0.570	2.860	0.916	30.33*	25.90	2823	1947	0.594	1.337	-1.049	0.663	2.562	0.832	31.4
600S162-68	0.0713	50	56.6	0.693	2.36	3.525	1.175	2.255	0.218	0.560	3.525	1.164	39.47*	35.70	5350	2879	1.174	1.626	-1.032	0.655	2.543	0.835	30.8
600S162-97	0.1017	50	59.2	0.966	3.29	4.797	1.599	2.229	0.283	0.541	4.797	1.599	56.73*	56.73	10472	3805	3.329	2.153	-0.997	0.636	2.501	0.841	29.8
600S162-118	0.1242	50	61.1	1.158	3.94	5.652	1.884	2.209	0.321	0.526	5.652	1.884	68.94	68.94	12526	3622	5.956	2.487	-0.971	0.623	2.470	0.845	29.1
600S200-33	0.0346	33	33.0	0.379	1.29	2.075	0.692	2.340	0.209	0.743	2.058	0.621	12.28	10.76	638	638	0.151	1.593	-1.457	0.901	2.855	0.740	51.6
600S200-43	0.0451	33	33.0	0.492	1.67	2.683	0.894	2.335	0.268	0.739	2.683	0.873	17.24	15.39	1416	1240	0.334	2.033	-1.446	0.894	2.844	0.742	51.5
600S200-54	0.0566	50	50.0	0.613	2.09	3.319	1.106	2.327	0.328	0.732	3.319	1.015	30.40	27.38	2823	1947	0.655	2.493	-1.432	0.887	2.829	0.744	41.6
600S200-68	0.0713	50	55.4	0.764	2.60	4.101	1.367	2.316	0.400	0.723	4.101	1.317	43.71*	39.69	5350	2879	1.295	3.047	-1.415	0.878	2.809	0.746	39.3
600S200-97	0.1017	50	57.6	1.067	3.63	5.612	1.871	2.293	0.530	0.705	5.612	1.871	64.53*	63.67	10472	3805	3.679	4.080	-1.378	0.859	2.767	0.752	38.3
600S200-118	0.1242	50	59.2	1.283	4.36	6.641	2.214	2.276	0.611	0.690	6.641	2.214	78.44	78.44	12526	3622	6.595	4.753	-1.351	0.845	2.735	0.756	37.6
600S250-43	0.0451	33	33.0	0.537	1.83	3.082	1.027	2.396	0.458	0.923	3.082	0.918	18.14	16.21	1416	1240	0.364	3.411	-1.874	1.136	3.179	0.652	62.4
600S250-54	0.0566	50	50.0	0.670	2.28	3.819	1.273	2.388	0.562	0.917	3.766	1.069	32.00	28.71	2823	1947	0.715	4.194	-1.860	1.129	3.163	0.654	50.5
600S250-68	0.0713	50	50.0	0.836	2.84	4.727	1.576	2.378	0.688	0.908	4.723	1.386	41.49	39.07	5350	2879	1.416	5.145	-1.842	1.119	3.142	0.656	50.4
600S250-97	0.1017	50	56.2	1.169	3.98	6.496	2.165	2.357	0.923	0.889	6.496	2.063	69.38*	66.81	10472	3805	4.030	6.947	-1.803	1.100	3.098	0.661	47.3
600S250-118	0.1242	50	57.4	1.407	4.79	7.713	2.571	2.342	1.075	0.874	7.713	2.498	85.92	86.83	12526	3622	7.234	8.142	-1.775	1.085	3.066	0.665	46.6
600S300-54	0.0566	50	50.0	0.754	2.57	4.462	1.487	2.432	0.986	1.143	4.332	1.277	38.23	33.68	2823	1947	0.806	8.115	-2.483	1.481	3.659	0.539	59.1
600S300-68	0.0713	50	50.0	0.943	3.21	5.534	1.845	2.423	1.214	1.135	5.534	1.610	48.20	45.90	5350	2879	1.597	9.992	-2.465	1.471	3.638	0.541	59.0
600S300-97	0.1017	50	50.0	1.321	4.50	7.639	2.546	2.404	1.649	1.117	7.639	2.442	73.11	72.75	10472	3805	4.556	13.587	-2.427	1.451	3.594	0.544	58.8
600S300-118	0.1242	50	56.3	1.593	5.42	9.100	3.033	2.390	1.940	1.104	9.100	2.939	99.02	99.47	12526	3622	8.1914	16.0127	-2.398	1.437	3.561	0.546	55.3
600S350-54	0.0566	50	50.0	0.825	2.81	5.023	1.674	2.467	1.491	1.344	4.774	1.335	39.97	36.56	2823	1947	0.8812	12.9421	-3.037	1.787	4.137	0.461	74.4
600S350-68	0.0713	50	50.0	1.032	3.51	6.237	2.079	2.459	1.841	1.336	6.207	1.771	53.01	49.70	5350	2879	1.7483	15.9678	-3.018	1.777	4.115	0.462	74.3
600S350-97	0.1017	50	50.0	1.449	4.93	8.631	2.877	2.441	2.518	1.318	8.631	2.593	77.64	78.36	10472	3805	4.9943	21.811	-2.979	1.757	4.071	0.464	74.3
600S350-118	0.1242	50	55.4	1.748	5.95	10.304	3.435	2.428	2.978	1.305	10.304	3.268	108.43	107.66	12526	3622	8.9897	25.7905	-2.951	1.742	4.038	0.466	70.6
800S137-33[1]	0.0346	33	33.0	0.388	1.32	3.198	0.799	2.873	0.073	0.435	2.998	0.622	12.3	10.71	474	474	0.155	0.957	-0.696	0.460	2.987	0.946	32.5
800S137-43	0.0451	33	33.0	0.503	1.71	4.134	1.033	2.866	0.093	0.430	4.001	0.896	17.7	15.78	1051	1051	0.341	1.214	-0.687	0.454	2.978	0.947	32.2
800S137-54	0.0566	50	50.0	0.627	2.13	5.110	1.277	2.855	0.112	0.423	4.974	1.083	32.42	28.47	2091	2091	0.670	1.478	-0.676	0.448	2.964	0.948	25.9
800S137-68	0.0713	50	50.0	0.782	2.66	6.303	1.576	2.839	0.134	0.414	6.285	1.468	43.96	39.57	4221	3367	1.325	1.789	-0.661	0.440	2.944	0.950	25.6
800S137-97	0.1017	50	50.0	1.093	3.72	8.597	2.149	2.805	0.169	0.394	8.597	2.149	64.35	63.91	10885	5938	3.767	2.349	-0.630	0.423	2.902	0.953	25.0
800S162-33[1]	0.0346	33	33.0	0.413	1.41	3.582	0.896	2.943	0.125	0.550	3.384	0.710	14.03	12.61	474	474	0.165	1.630	-0.936	0.607	3.137	0.911	40.1
800S162-43	0.0451	33	33.0	0.537	1.83	4.633	1.158	2.937	0.160	0.546	4.500	1.019	20.14	18.33	1051	1051	0.364	2.076	-0.926	0.601	3.128	0.912	39.9
800S162-54	0.0566	50	50.0	0.670	2.28	5.736	1.434	2.927	0.194	0.539	5.600	1.229	36.79	32.81	2091	2091	0.715	2.539	-0.914	0.594	3.113	0.914	32.1
800S162-68	0.0713	50	50.0	0.836	2.84	7.089	1.772	2.913	0.235	0.530	7.070	1.663	49.8	45.11	4221	3367	1.416	3.093	-0.899	0.586	3.094	0.916	31.9
800S162-97	0.1017	50	50.0	1.169	3.98	9.713	2.428	2.883	0.305	0.510	9.713	2.428	72.7	71.94	10885	5938	4.030	4.114	-0.866	0.568	3.053	0.919	31.4
800S162-118	0.1242	50	61.1	1.407	4.79	11.504	2.876	2.860	0.346	0.496	11.504	2.876	105.2268	105.23	16235	7115	7.234	4.766	-0.842	0.556	3.022	0.922	28.0
800S200-33[1]	0.0346	33	33.0	0.448	1.52	4.096	1.024	3.023	0.227	0.712	4.096	0.816	16.12	14.52	474	474	0.179	2.971	-1.288	0.817	3.363	0.853	50.5
800S200-43	0.0451	33	33.0	0.582	1.98	5.302	1.325	3.018	0.292	0.708	5.302	1.293	25.54	20.99	1051	1051	0.395	3.797	-1.277	0.811	3.353	0.855	50.4
800S200-54	0.0566	50	50.0	0.726	2.47	6.573	1.643	3.009	0.357	0.701	6.573	1.499	44.87	37.37	2091	2091	0.775	4.663	-1.265	0.804	3.338	0.856	40.7
800S200-68	0.0713	50	55.4	0.907	3.09	8.140	2.035	2.996	0.435	0.692	8.140	1.964	65.21*	54.70	4221	3367	1.537	5.712	-1.248	0.796	3.319	0.859	38.4
800S200-97	0.1017	50	57.6	1.271	4.32	11.203	2.801	2.969	0.576	0.673	11.203	2.801	96.63*	89.76	10885	5938	4.381	7.684	-1.214	0.777	3.278	0.863	37.2
800S200-118	0.1242	50	59.2	1.531	5.21	13.316	3.329	2.949	0.665	0.659	13.316	3.329	117.9528	117.55	16235	7115	7.872	8.981	-1.188	0.764	3.247	0.866	36.5
800S250-43	0.0451	33	33.0	0.627	2.13	6.015	1.504	3.097	0.500	0.893	6.015	1.313	25.95	22.06	1051	1051	0.425	6.374	-1.675	1.043	3.632	0.787	61.5
800S250-54	0.0566	50	50.0	0.783	2.66	7.465	1.866	3.088	0.614	0.886	7.378	1.525	45.66	39.13	2091	2091	0.836	7.850	-1.661	1.036	3.617	0.789	49.8
800S250-68	0.0713	50	50.0	0.978	3.33	9.261	2.315	3.077	0.752	0.877	9.240	2.059	61.65	53.75	4221	3367	1.658	9.652	-1.644	1.027	3.597	0.791	49.6
800S250-97	0.1017	50	56.2	1.372	4.67	12.789	3.197	3.053	1.009	0.857	12.789	3.054	102.70*	93.42	10885	5938	4.731	13.091	-1.607	1.008	3.555	0.796	46.4
800S250-118	0.1242	50	57.4	1.655	5.63	15.242	3.810	3.035	1.175	0.843	15.242	3.707	127.5072	122.92	16235	7115	8.511	15.395	-1.580	0.994	3.524	0.799	45.6
800S300-54	0.0566	50	50.0	0.868	2.95	8.657	2.164	3.159	1.085	1.118	8.443	1.826	54.66	45.96	2091	2091	0.927	14.642	-2.244	1.372	4.033	0.690	58.6
800S300-68	0.0713	50	50.0	1.085	3.69	10.758	2.690	3.149	1.336	1.110	10.758	2.371	70.98	63.08	4221	3367	1.839	18.066	-2.226	1.363	4.012	0.692	58.4
800S300-97	0.1017	50	50.0	1.525	5.19	14.913	3.728	3.127	1.817	1.092	14.913	3.576	107.05	101.38	10885	5938	5.257	24.677	-2.188	1.343	3.970	0.696	58.1
800S300-118	0.1242	50	56.3	1.842	6.27	17.824	4.456	3.111	2.139	1.078	17.824	4.316	145.434	139.91	16235	7115	9.469	29.179	-2.161	1.329	3.938	0.699	54.5
800S350-54	0.0566	50	50.0	0.938	3.19	9.683	2.421	3.212	1.646	1.325	9.310	1.869	55.9632	49.74	2091	2091	1.002	22.897	-2.766	1.668	4.441	0.612	73.0
800S350-68	0.0713	50	50.0	1.174	4.00	12.046	3.012	3.203	2.034	1.316	12.046	2.596	77.7324	68.05	4221	3367	1.990	28.308	-2.748	1.658	4.421	0.614	72.9
800S350-97	0.1017	50	50.0	1.652	5.62	16.737	4.184	3.183	2.784	1.298	16.737	3.786	113.3388	108.67	10885	5938	5.696	38.834	-2.710	1.639	4.377	0.617	72.7
800S350-118	0.1242	50	55.4	1.997	6.79	20.041	5.010	3.168	3.295	1.285	20.041	4.762	158.0208	150.37	16235	7115	10.267	46.068	-2.682	1.624	4.345	0.619	68.9

Notes:

1. Web-height to thickness ratio exceeds 200. Web Stiffeners are required at all support points and concentrated loads.

*Where Ma is noted with an asterisk, cold-work of forming is applicable and has been used.

DESIGN JAMBS



$P_{1D} = 2'(5')15\ PSF = 150\#$
$P_{1L} = 2'(5')100\ PSF = 1000\#$
$\Sigma P = 1150\#$
$w_L = 2'(5\ PSF) = 10\ PLF$

USE 6005162-43 MIN

$P_{ALLOW} = 2.85K > \Sigma P$, OK
- SEE ATTACHED

Allowable Combined Axial and Bending Loads 5psf Lateral Load

Wall	Spacing	362S137-mils (Fy)					362S162-mils (Fy)					
Ht. (ft)	(in) o.c.	-33 (33)	-43 (33)	-54 (50)	-68 (50)	-97 (50)	-33 (33)	-43 (33)	-54 (50)	-68 (50)	-97 (50)	-118 (50)
8	12	1.49 [6]	2.14 [6]	3.32 [6]	4.37 [6]	6.12 [6]	1.87 [6]	2.65 [6]	4.15 [6]	5.38 [6]	7.90 [6]	9.80 [6]
	16	1.42 [6]	2.07 [6]	3.26 [6]	4.30 [6]	6.06 [6]	1.80 [6]	2.57 [6]	4.08 [6]	5.31 [6]	7.83 [6]	9.73 [6]
	24	1.29 [6]	1.93 [6]	3.13 [6]	4.17 [6]	5.95 [6]	1.65 [6]	2.42 [6]	3.94 [6]	5.17 [6]	7.70 [6]	9.59 [6]
9	12	1.38 [6]	2.01 [6]	3.11 [6]	4.07 [6]	6.05 [6]	1.74 [6]	2.48 [6]	3.86 [6]	4.99 [6]	7.32 [6]	9.05 [6]
	16	1.30 [6]	1.92 [6]	3.02 [6]	3.99 [6]	5.97 [6]	1.64 [6]	2.38 [6]	3.77 [6]	4.90 [6]	7.23 [6]	8.96 [6]
	24	1.13 [6]	1.74 [6]	2.87 [6]	3.82 [6]	5.81 [6]	1.46 [6]	2.19 [6]	3.60 [6]	4.72 [6]	7.06 [6]	8.78 [6]
10	12	1.26 [6]	1.85 [6]	2.85 [6]	3.73 [6]	5.67 [6]	1.58 [6]	2.29 [6]	3.53 [6]	4.55 [6]	6.67 [6]	8.22 [6]
	16	1.16 [6]	1.75 [6]	2.75 [6]	3.63 [6]	5.57 [6]	1.47 [6]	2.17 [6]	3.42 [6]	4.44 [6]	6.57 [6]	8.11 [6]
	24	0.96 [6]	1.54 [6]	2.57 [6]	3.44 [6]	5.38 [6]	1.26 [6]	1.95 [6]	3.22 [6]	4.23 [6]	6.37 [6]	7.90 [6]
12	12	0.99 [6]	1.51 [6]	2.27 [6]	2.97 [6]	4.48 [6]	1.25 [6]	1.87 [6]	2.79 [6]	3.60 [6]	5.29 [6]	6.48 [6]
	16	0.86 [5]	1.37 [6]	2.15 [6]	2.85 [6]	4.36 [6]	1.11 [6]	1.72 [6]	2.66 [6]	3.47 [6]	5.16 [6]	6.34 [6]
	24	0.63 [3]	1.12 [4]	1.93 [5]	2.62 [6]	4.13 [6]	0.86 [4]	1.44 [5]	2.42 [6]	3.22 [6]	4.92 [6]	6.08 [6]
14	12	0.72 [4]	1.15 [5]	1.75 [6]	2.30 [6]	3.45 [6]	0.93 [5]	1.44 [6]	2.14 [6]	2.78 [6]	4.10 [6]	4.98 [6]
	16	0.59 [3]	1.00 [4]	1.62 [5]	2.16 [6]	3.32 [6]	0.78 [3]	1.28 [5]	2.00 [6]	2.64 [6]	3.95 [6]	4.83 [6]
	24	0.34 [2]	0.73 [2]	1.39 [3]	1.92 [4]	3.07 [6]	0.52 [2]	0.99 [3]	1.75 [4]	2.38 [5]	3.69 [6]	4.55 [6]
16	12	0.50 [3]	0.83 [3]	1.33 [4]	1.76 [5]	2.66 [6]	0.65 [3]	1.06 [4]	1.63 [5]	2.14 [6]	3.18 [6]	3.86 [6]
	16	0.36 [2]	0.68 [2]	1.20 [3]	1.63 [4]	2.53 [6]	0.51 [2]	0.90 [3]	1.49 [4]	2.00 [6]	3.04 [6]	3.71 [6]
	24	0.12 [1]	0.42 [2]	0.97 [2]	1.39 [2]	2.28 [6]	0.25 [1]	0.62 [2]	1.25 [2]	1.74 [4]	2.78 [4]	3.44 [6]

Wall	Spacing	362S200-mils (Fy)						362S250-mils (Fy)				
Ht. (ft)	(in) o.c.	-33 (33)	-43 (33)	-54 (50)	-68 (50)	-97 (50)	-118 (50)	-43 (33)	-54 (50)	-68 (50)	-97 (50)	-118 (50)
8	12	2.25 [6]	3.28 [6]	5.18 [6]	6.68 [6]	9.57 [6]	11.69 [6]	3.71 [6]	5.82 [6]	7.76 [6]	11.05 [6]	13.44 [6]
	16	2.17 [6]	3.20 [6]	5.10 [6]	6.60 [6]	9.50 [6]	11.62 [6]	3.62 [6]	5.73 [6]	7.67 [6]	10.98 [6]	13.36 [6]
	24	2.01 [6]	3.03 [6]	4.94 [6]	6.45 [6]	9.36 [6]	11.47 [6]	3.45 [6]	5.56 [6]	7.50 [6]	10.83 [6]	13.22 [6]
9	12	2.10 [6]	3.07 [6]	4.79 [6]	6.17 [6]	8.84 [6]	10.79 [6]	3.52 [6]	5.46 [6]	7.17 [6]	10.24 [6]	12.43 [6]
	16	2.00 [6]	2.96 [6]	4.69 [6]	6.07 [6]	8.75 [6]	10.70 [6]	3.40 [6]	5.35 [6]	7.06 [6]	10.14 [6]	12.34 [6]
	24	1.80 [6]	2.76 [6]	4.49 [6]	5.88 [6]	8.58 [6]	10.51 [6]	3.18 [6]	5.14 [6]	6.85 [6]	9.96 [6]	12.16 [6]
10	12	1.93 [6]	2.84 [6]	4.37 [6]	5.61 [6]	8.06 [6]	9.82 [6]	3.29 [6]	5.08 [6]	6.54 [6]	9.36 [6]	11.37 [6]
	16	1.81 [6]	2.71 [6]	4.25 [6]	5.49 [6]	7.95 [6]	9.71 [6]	3.15 [6]	4.95 [6]	6.40 [6]	9.25 [6]	11.25 [6]
	24	1.57 [6]	2.47 [6]	4.01 [6]	5.27 [6]	7.74 [6]	9.49 [6]	2.89 [6]	4.69 [6]	6.15 [6]	9.03 [6]	11.03 [6]
12	12	1.56 [6]	2.32 [6]	3.45 [6]	4.44 [6]	6.42 [6]	7.80 [6]	2.74 [6]	4.06 [6]	5.21 [6]	7.53 [6]	9.13 [6]
	16	1.40 [6]	2.16 [6]	3.30 [6]	4.30 [6]	6.28 [6]	7.65 [6]	2.55 [6]	3.90 [6]	5.05 [6]	7.38 [6]	8.99 [6]
	24	1.12 [4]	1.86 [6]	3.03 [6]	4.03 [6]	6.02 [6]	7.38 [6]	2.22 [6]	3.59 [6]	4.74 [6]	7.11 [6]	8.70 [6]
14	12	1.18 [6]	1.81 [6]	2.64 [6]	3.43 [6]	5.00 [6]	6.05 [6]	2.15 [6]	3.12 [6]	4.05 [6]	5.91 [6]	7.17 [6]
	16	1.01 [4]	1.63 [5]	2.48 [6]	3.27 [6]	4.84 [6]	5.89 [6]	1.95 [6]	2.94 [6]	3.87 [6]	5.75 [6]	7.00 [6]
	24	0.70 [3]	1.31 [3]	2.19 [4]	2.99 [6]	4.56 [6]	5.60 [6]	1.59 [4]	2.62 [5]	3.54 [6]	5.45 [6]	6.69 [6]
16	12	0.84 [4]	1.36 [5]	2.01 [6]	2.66 [6]	3.91 [6]	4.74 [6]	1.63 [6]	2.40 [6]	3.15 [6]	4.67 [6]	5.67 [6]
	16	0.67 [3]	1.18 [4]	1.86 [4]	2.50 [6]	3.76 [6]	4.57 [6]	1.42 [4]	2.22 [5]	2.97 [6]	4.50 [6]	5.49 [6]
	24	0.38 [2]	0.86 [2]	1.58 [3]	2.21 [4]	3.47 [5]	4.28 [6]	1.06 [3]	1.90 [3]	2.64 [4]	4.19 [6]	5.17 [6]

Wall	Spacing	362S300-mils (Fy)				362S350-mils (Fy)			
Ht. (ft)	(in) o.c.	-54 (50)	-68 (50)	-97 (50)	-118 (50)	-54 (50)	-68 (50)	-97 (50)	-118 (50)
8	12	5.86 [6]	8.17 [6]	12.16 [6]	15.14 [6]	7.83 [6]	11.10 [6]	16.12 [6]	19.46 [6]
	16	5.78 [6]	8.08 [6]	12.08 [6]	15.07 [6]	7.74 [6]	11.00 [6]	16.02 [6]	19.38 [6]
	24	5.63 [6]	7.91 [6]	11.92 [6]	14.93 [6]	7.56 [6]	10.81 [6]	15.83 [6]	19.21 [6]
9	12	5.53 [6]	7.65 [6]	11.48 [6]	14.05 [6]	7.36 [6]	10.36 [6]	14.89 [6]	17.99 [6]
	16	5.43 [6]	7.55 [6]	11.37 [6]	13.96 [6]	7.25 [6]	10.23 [6]	14.77 [6]	17.88 [6]
	24	5.23 [6]	7.33 [6]	11.17 [6]	13.77 [6]	7.02 [6]	9.98 [6]	14.52 [6]	17.67 [6]
10	12	5.16 [6]	7.06 [6]	10.59 [6]	12.88 [6]	6.85 [6]	9.55 [6]	13.60 [6]	16.44 [6]
	16	5.03 [6]	6.93 [6]	10.46 [6]	12.77 [6]	6.71 [6]	9.40 [6]	13.44 [6]	16.31 [6]
	24	4.79 [6]	6.67 [6]	10.21 [6]	12.55 [6]	6.43 [6]	9.10 [6]	13.15 [6]	16.04 [6]
12	12	4.40 [6]	5.85 [6]	8.56 [6]	10.45 [6]	5.71 [6]	7.72 [6]	10.95 [6]	13.28 [6]
	16	4.23 [6]	5.67 [6]	8.40 [6]	10.30 [6]	5.52 [6]	7.52 [6]	10.75 [6]	13.10 [6]
	24	3.91 [6]	5.34 [6]	8.08 [6]	10.01 [6]	5.16 [6]	7.14 [6]	10.38 [6]	12.76 [6]
14	12	3.55 [6]	4.66 [6]	6.76 [6]	8.28 [6]	4.52 [6]	5.96 [6]	8.53 [6]	10.39 [6]
	16	3.35 [6]	4.46 [6]	6.57 [6]	2.10 [6]	4.31 [6]	5.74 [6]	8.31 [6]	10.19 [6]
	24	3.00 [6]	4.09 [6]	6.22 [6]	7.78 [6]	3.92 [6]	5.65 [6]	7.90 [6]	9.82 [6]
16	12	2.77 [6]	3.64 [6]	5.36 [6]	6.60 [6]	3.55 [6]	4.64 [6]	6.71 [6]	8.22 [6]
	16	2.56 [6]	3.44 [6]	5.16 [6]	6.41 [6]	3.33 [6]	4.42 [6]	6.48 [6]	8.01 [6]
	24	2.21 [4]	3.07 [5]	4.80 [6]	6.08 [6]	2.94 [6]	4.02 [6]	6.07 [6]	7.63 [6]

Notes:

- [1] Deflection meets L/120
- [2] Deflection meets L/240
- [3] Deflection meets L/360
- [4] Deflection meets L/480
- [5] Deflection meets L/600
- [6] Deflection meets L/720
- Axial Load Multiplier = 1
- KyLy & KtLt = 48
- Lateral Load Multiplier - Strength = 1
- Lateral Load Multiplier - Deflection = 1.0
- * h/t > 200, stiffeners are required at supports

DESIGN SCREENWALL

MWFRS WIND LOADS PER ASCE 7-22, SEC. 29.3

$q_h = 0.00256 K_z K_{zt} K_e V^2 = 31.3$ PSF (EQ 26.10-1)

$K_z = 0.85$
$K_{zt} = 1.0$
$K_e = 1.0$
V = 120 MPH (RC II FOR SCREEWALL ONLY)
EXPOSURE : C

$F = q_h K_d G C_f A_s$ =77.8 PSF AT 0 TO s (CASE C)
= 29.4 PSF AT CASE A AND CASE C >5s

$K_d = 0.85$
$G = 0.85$
B/s = 668'/10.4' = 64, MIN
s/h = 1.0

CASE A C_f = 1.3 MAX

CASE C C_f = 0.8(4.30)=3.44 AT 0 TO s
0.8(0.55)=0.44 AT > 10s

SEISMIC LOAD PER ASCE 7-22 SEC 13.3

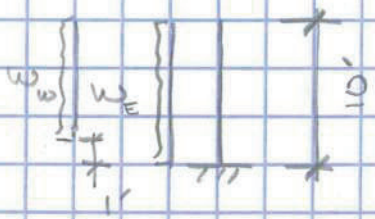
$F_p = 0.4 S_{DS} I_p W_p \left[\frac{H_F}{R_\mu}\right]\left[\frac{C_{AR}}{R_{po}}\right]$ = $0.48 S_{DS} I_p W_p$ = 51.5 PSF

$F_{p\,max} = 1.6 S_{DS} I_p W_p$ =
$F_{p\,min} = 0.35 S_{DS} I_p W_p$ =

$S_{DS} = 1.34$
$I_p = 1.0$
$W_p = 80$ PSF
$H_F = 1.0$
$R_\mu = 1.0$
$C_{AR} = 1.8$
$R_{po} = 1.5$

DESIGN MASONRY SCREENWALL

NEAR ENDS, 10' TALL, W = 77.8 PSF

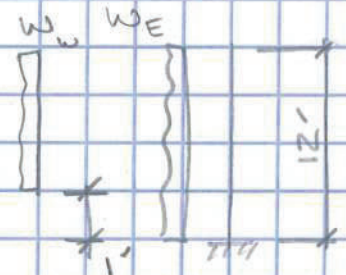


W_W = 77.8 PSF
W_E = 51.5 PSF

USE 8" SOLID GROUTED CMU (f'_m = 2.5 ksi) W/ #6 VERTS @ 16" O.C. CENTERED IN WALL.

CC = 0.76 < 1, O.K.
- SEE ATTACHED

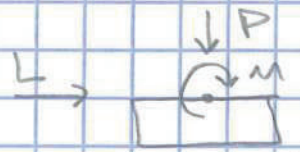
NEAR MIDDLE, 12' TALL, W = 29.4 PSF



W_W = 29.4 PSF
W_E = 51.5 PSF

USE SAME AS ABOVE
CC = 0.72 < 1, OK
- SEE ATTACHED

DESIGN FOOTING



P_D = 10'(80 PSF) = 800 PLF
L_W = 77.8 PSF(9') = 700 PLF
L_E = 51.5 PSF(10') = 515 PLF
M_W = L_W(6') = 4.2 K-ft/ft
M_E = L_E(5') = 2.6 K-ft

USE 5'-3" W x 12" D CONT. CONC. FTG W/ #5 TRANSVERSE AT 14" O.C. MIN T+B.

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Masonry Screenwall Near Middle

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

Construction Type : Grouted Hollow Concrete Masonry

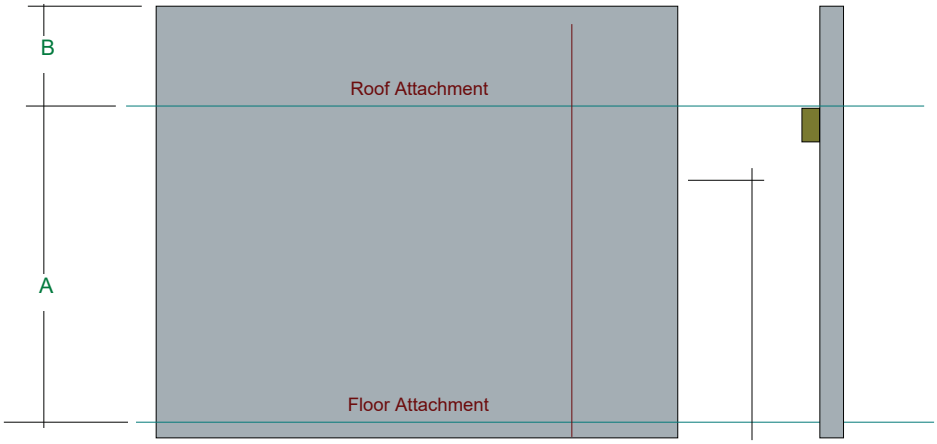
F'm	=	2.5 ksi	Nom. Wall Thickness	8 in	Temp Diff across thickness	=		deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	7.625 in	Min Allow Out-of-plane Defl Ra	=	150.0	
Fr - Rupture	=	61.0 psi	Rebar "d" distance	3.8125 in				
Em = f'm * 900	=	2,250,000 psi	Lower Level Rebar . . .		Minimum Vertical Steel %	=	0.0020	
n	=	12.89	Bar Size #	6	Max % of ρ bal.	=	0.008795	
Grout Density	=	140 pcf	Bar Spacing	16 in				
Block Weight	Medium Weight							
Wall Weight	=	81.0 psf						

Wall is Solid Grouted

One-Story Wall Dimensions

A	Clear Height	=	12.0 ft
B	Parapet height	=	ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :
Wind Load (Full Height) psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load 51.50 psf

Fp 1.0 = 51.50 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load					0.0290 k/ft	12.0	1.0 ft

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Masonry Screenwall Near Middle

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

Governing Load Combination . . .		Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +0.90D+E	Maximum Bending Stress Ratio	**0.7199**		
		Max Mu	-3.775 k-ft	Phi * Mn	5.244 k-ft
PASS	Service Deflection Check +0.70E	Actual Defl. Ratio L/	205	Allowable Defl. Ratio	150.0 /2 for Cantilever
		Max. Deflection	1.404 in	Max. Allow. Defl.	1.920 in
PASS	Axial Load Check +1.20D+E	Max Pu / Ag	12.731 psi	Pu Max	1.166k
		Max Pu Location	0.20 ft	Ag	91.560 in2
PASS	Reinforcing Limit Check			0.2 * f'm	500.0 psi
		Actual ρ	0.007213	Max Allow ρ	0.008312

Maximum Reactions *for Load Combination...*

Top Horizontal	0.0	0.0 k
Base Horizontal	E Only	0.6180 k
Vertical Reaction	+D+0.60W	0.9720 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	ρ Actual	ρ Max Allow	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 0.40	1.166	45.780	0.59	1.04	0.90	5.31	0.330	0.0072	0.0084	3.81
+1.20D+W at 0.00 to 0.40	1.166	45.780	0.59	2.10	0.90	5.31	0.330	0.0072	0.0084	3.81
+0.90D+W at 0.00 to 0.40	0.875	45.780	0.59	2.09	0.90	5.24	0.330	0.0072	0.0085	3.81
+1.20D+E at 0.00 to 0.40	1.166	45.780	0.59	3.80	0.90	5.31	0.330	0.0072	0.0084	3.81
+0.90D+E at 0.00 to 0.40	0.874	45.780	0.59	3.78	0.90	5.24	0.330	0.0072	0.0085	3.81

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
+0.70E at 11.60 to 12.00	0.004	0.59	0.00	443.30	37.29	443.300	1.404	205.1
+0.60W at 11.60 to 12.00	0.001	0.59	0.00	443.30	37.29	443.300	0.386	746.8

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	0.972 k
+D+0.60W	0.2 k	0.00 k	0.972 k
+D+0.450W	0.1 k	0.00 k	0.972 k
+0.60D+0.60W	0.2 k	0.00 k	0.583 k
+D+0.70E	0.4 k	0.00 k	0.972 k
+D+0.5250E	0.3 k	0.00 k	0.972 k
+0.60D+0.70E	0.4 k	0.00 k	0.583 k
W Only	0.3 k	0.00 k	0.000 k
E Only	0.6 k	0.00 k	0.000 k

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Masonry Screenwall Near Ends

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : TMS 402-22
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

Construction Type : Grouted Hollow Concrete Masonry

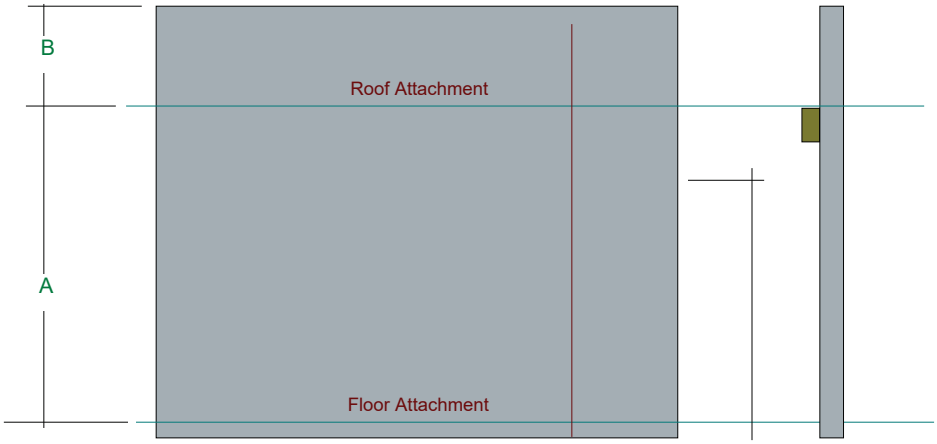
F'm	=	2.5 ksi	Nom. Wall Thickness	8 in	Temp Diff across thickness	=		deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	7.625 in	Min Allow Out-of-plane Defl Ra	=	150.0	
Fr - Rupture	=	61.0 psi	Rebar "d" distance	3.8125 in				
Em = f'm * 900	=	2,250,000 psi	Lower Level Rebar . . .		Minimum Vertical Steel %	=	0.0020	
n	=	12.89	Bar Size #	6	Max % of ρ bal.	=	0.008798	
Grout Density	=	140 pcf	Bar Spacing	16 in				
Block Weight	Medium Weight							
Wall Weight	=	81.0 psf						

Wall is Solid Grouted

One-Story Wall Dimensions

A	Clear Height	=	10.0 ft
B	Parapet height	=	ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :
Wind Load (Full Height) psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load 51.50 psf

Fp 1.0 = 51.50 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load					0.0780 k/ft	10.0	ft

Project Title:
Engineer:
Project ID:
Project Descr:

Masonry Slender Wall

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Masonry Screenwall Near Ends

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +0.90D+W	Maximum Bending Stress Ratio	**0.7562**		
		Max Mu	-3.941 k-ft	Phi * Mn	5.211 k-ft
PASS	Service Deflection Check +0.60W	Actual Defl. Ratio L/	286	Allowable Defl. Ratio	150.0 /2 for Cantilever
		Max. Deflection	0.8393 in	Max. Allow. Defl.	1.60 in
PASS	Axial Load Check +1.20D+W	Max Pu / Ag	10.607 psi	Pu Max	0.9712k
		Max Pu Location	0.1667 ft	Ag	91.560 in2
PASS	Reinforcing Limit Check			0.2 * f'm	500.0 psi
		Actual ρ	0.007213	Max Allow ρ	0.008395

Maximum Reactions *for Load Combination...*

Top Horizontal	0.0	0.0 k
Base Horizontal	W Only	0.780 k
Vertical Reaction	+D+0.70E	0.810 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Axial Load 0.2*f'm*b*t k	Moment Values Mcr k-ft	Moment Values Mu k-ft	Moment Values Phi	Moment Values Phi Mn k-ft	As in^2	ρ Actual	ρ Max Allow	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 0.33	0.972	45.780	0.59	1.97	0.90	5.27	0.330	0.0072	0.0085	3.81
+1.20D+W at 0.00 to 0.33	0.971	45.780	0.59	3.95	0.90	5.27	0.330	0.0072	0.0085	3.81
+0.90D+W at 0.00 to 0.33	0.728	45.780	0.59	3.94	0.90	5.21	0.330	0.0072	0.0085	3.81
+1.20D+E at 0.00 to 0.33	0.972	45.780	0.59	2.61	0.90	5.27	0.330	0.0072	0.0085	3.81
+0.90D+E at 0.00 to 0.33	0.729	45.780	0.59	2.60	0.90	5.21	0.330	0.0072	0.0085	3.81

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Moment Values Mactual k-ft	Stiffness I gross in^4	Stiffness I cracked in^4	Stiffness I effective in^4	Deflections Deflection in	Deflections Defl. Ratio
+0.70E at 9.67 to 10.00	0.002	0.59	0.00	443.30	37.29	443.300	0.554	433.5
+0.60W at 9.67 to 10.00	0.003	0.59	0.00	443.30	37.29	443.300	0.839	285.9

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	0.810 k
+D+0.60W	0.5 k	0.00 k	0.810 k
+D+0.450W	0.4 k	0.00 k	0.810 k
+0.60D+0.60W	0.5 k	0.00 k	0.486 k
+D+0.70E	0.4 k	0.00 k	0.810 k
+D+0.5250E	0.3 k	0.00 k	0.810 k
+0.60D+0.70E	0.4 k	0.00 k	0.486 k
W Only	0.8 k	0.00 k	0.000 k
E Only	0.5 k	0.00 k	0.000 k

Project Title:
Engineer:
Project ID:
Project Descr:

Wall Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Screenwall Footing

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	0.0018
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
AutoCalc Footing Weight as DL :		Yes

Soil Design Values

Allowable Soil Bearing	=	4.670 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	295.0 pcf
Soil/Concrete Friction Coeff.	=	0.450

Increases based on footing Depth

Reference Depth below Surface	=	ft
Allow. Pressure Increase per foot of depth	=	ksf
when base footing is below	=	ft

Increases based on footing Width

Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft

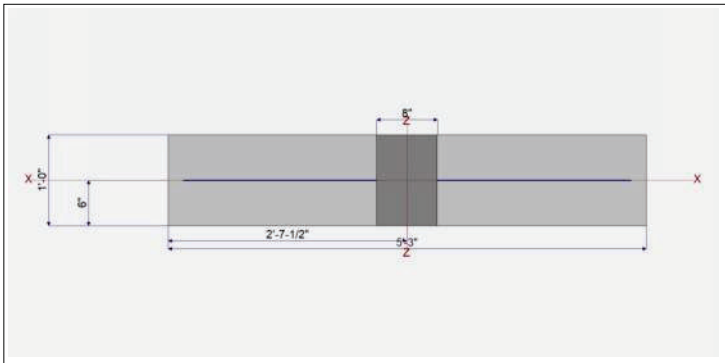
Adjusted Allowable Bearing Pressure = 4.670 ksf

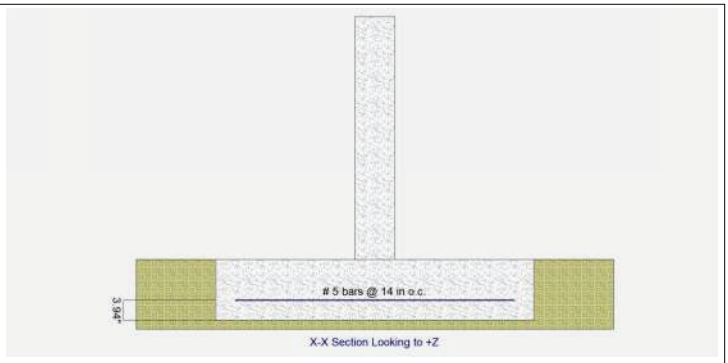
Dimensions

Footing Width	=	5.250 ft	Footing Thickness	=	12.0 in		
Wall Thickness	=	8.0 in	Rebar Centerline to Edge of Concrete...				
Wall center offset from center of footing	=	0 in	at Bottom of footing	=	3.940 in		

Reinforcing

Bars along X-X Axis		
Bar spacing	=	14.00
Reinforcing Bar Size	=	# 5





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	0.80							k
OB : Overburden	=	0.110							ksf
V-x	=					0.70	0.520		k
M-zz	=					4.20	2.60		k-ft
Vx applied	=	in above top of footing							

Project Title:
Engineer:
Project ID:
Project Descr:

Wall Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Screenwall Footing

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	1.106	Overturning - Z-Z	2.940 k-ft	3.253 k-ft	+0.60D+0.60W
PASS	1.328	Sliding - X-X	0.420 k	0.5577 k	+0.60D+0.60W
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.6987	Soil Bearing	3.263 ksf	4.670 ksf	+0.60D+0.60W
PASS	0.3997	Z Flexure (+X)	3.727 k-ft	9.326 k-ft	+1.20D+W
PASS	0.02788	Z Flexure (-X)	0.260 k-ft	9.326 k-ft	+0.90D+E
PASS	0.1404	1-way Shear (+X)	6.5 psi	46.027 psi	+1.40D
PASS	0.1404	1-way Shear (-X)	6.5 psi	46.027 psi	+1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio
D Only	4.670 ksf	0.0 in	0.3934 ksf	0.3934 ksf	0.084
+D+0.60W	4.670 ksf	17.081 in	0.0 ksf	1.145 ksf	0.245
+D+0.450W	4.670 ksf	12.811 in	0.0 ksf	0.8838 ksf	0.189
+0.60D+0.60W	4.670 ksf	28.469 in	0.0 ksf	3.263 ksf	0.699
+D+0.70E	4.670 ksf	12.689 in	0.0 ksf	0.8781 ksf	0.188
+D+0.5250E	4.670 ksf	9.517 in	0.03708 ksf	0.7497 ksf	0.161
+0.60D+0.70E	4.670 ksf	21.148 in	0.0 ksf	0.9571 ksf	0.205

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
D Only	None	0.0 k-ft	Infinity	OK
+D+0.60W	2.940 k-ft	5.422 k-ft	1.844	OK
+D+0.450W	2.205 k-ft	5.422 k-ft	2.459	OK
+0.60D+0.60W	2.940 k-ft	3.253 k-ft	1.106	OK
+D+0.70E	2.184 k-ft	5.422 k-ft	2.482	OK
+D+0.5250E	1.638 k-ft	5.422 k-ft	3.310	OK
+0.60D+0.70E	2.184 k-ft	3.253 k-ft	1.489	OK

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
D Only	0.0 k	0.9294 k	No Sliding	OK
+D+0.60W	0.420 k	0.9294 k	2.213	OK
+D+0.450W	0.3150 k	0.9294 k	2.951	OK
+0.60D+0.60W	0.420 k	0.5577 k	1.328	OK
+D+0.70E	0.3640 k	0.9294 k	2.553	OK
+D+0.5250E	0.2730 k	0.9294 k	3.405	OK
+0.60D+0.70E	0.3640 k	0.5577 k	1.532	OK

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
+1.40D	1.042	-X	Bottom	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+1.40D	1.042	+X	Bottom	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+1.20D	0.893	-X	Bottom	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+1.20D	0.893	+X	Bottom	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+1.20D+0.50W	0.09201	-X	Top	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+1.20D+0.50W	1.892	+X	Bottom	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+1.20D+W	0.3466	-X	Top	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+1.20D+W	3.727	+X	Bottom	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+0.90D+W	0.26	-X	Top	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+0.90D+W	0.26	+X	Top	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+1.20D+E	0.2737	-X	Top	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+1.20D+E	2.237	+X	Bottom	0.2592	ACI 7.6.1.1	0.2657	9.326	OK
+0.90D+E	0.26	-X	Top	0.2592	ACI 7.6.1.1	0.2657	9.326	OK

Project Title:
Engineer:
Project ID:
Project Descr:

Wall Footing

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Screenwall Footing

Footing Flexure

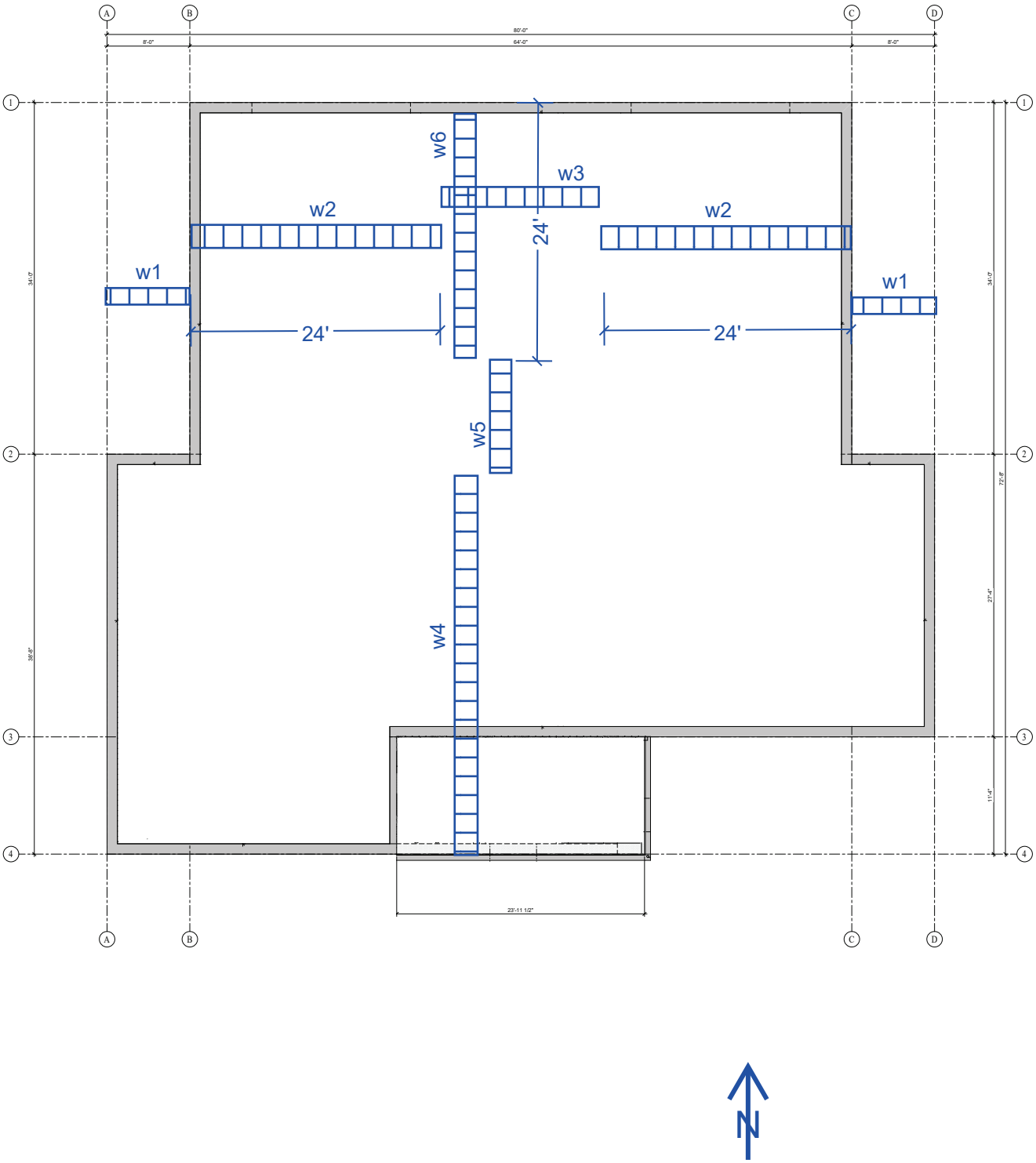
Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
+0.90D+E	2.253	+X	Bottom	0.2592	ACI 7.6.1.1	0.2657	9.326	OK

Units : k

One Way Shear

Load Combination...	vu @ -X	vu @ +X	vu:Max	Φ vn	vu / PHI vn	Status
+1.40D	6.5 psi	6.5 psi	6.5 psi	46.0 psi	0.140	OK
+1.20D	5.5 psi	5.5 psi	5.5 psi	46.0 psi	0.120	OK
+1.20D+0.50W	5.5 psi	5.5 psi	5.5 psi	46.0 psi	0.120	OK
+1.20D+W	5.5 psi	5.5 psi	5.5 psi	46.0 psi	0.120	OK
+0.90D+W	1.6 psi	1.6 psi	1.6 psi	46.0 psi	0.035	OK
+1.20D+E	5.5 psi	5.5 psi	5.5 psi	46.0 psi	0.120	OK
+0.90D+E	4.2 psi	4.2 psi	4.2 psi	46.0 psi	0.090	OK

MWFRS WIND LOADS (1.0W)

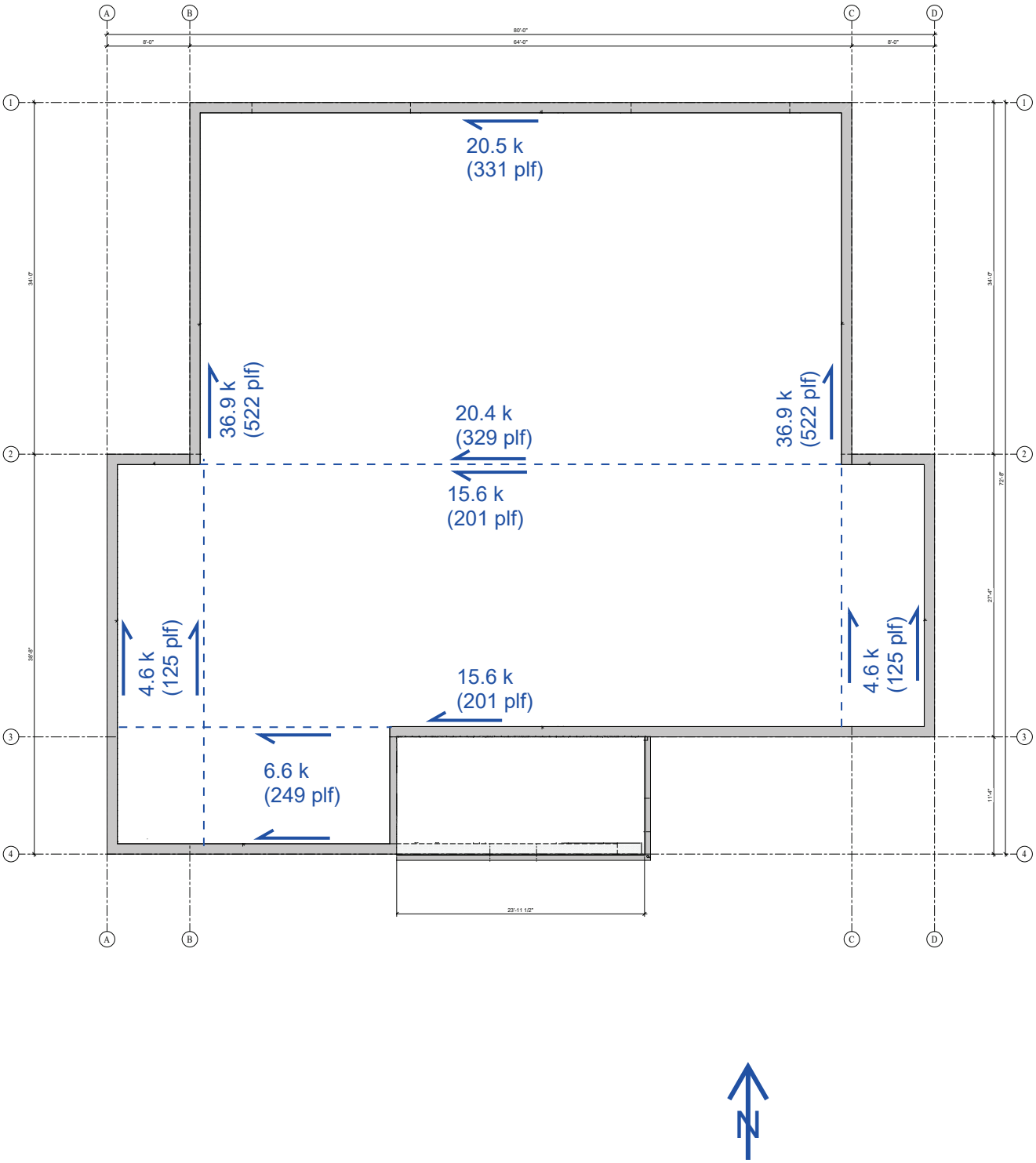


Uniform Horizontal Wind Loads for Lateral Analysis

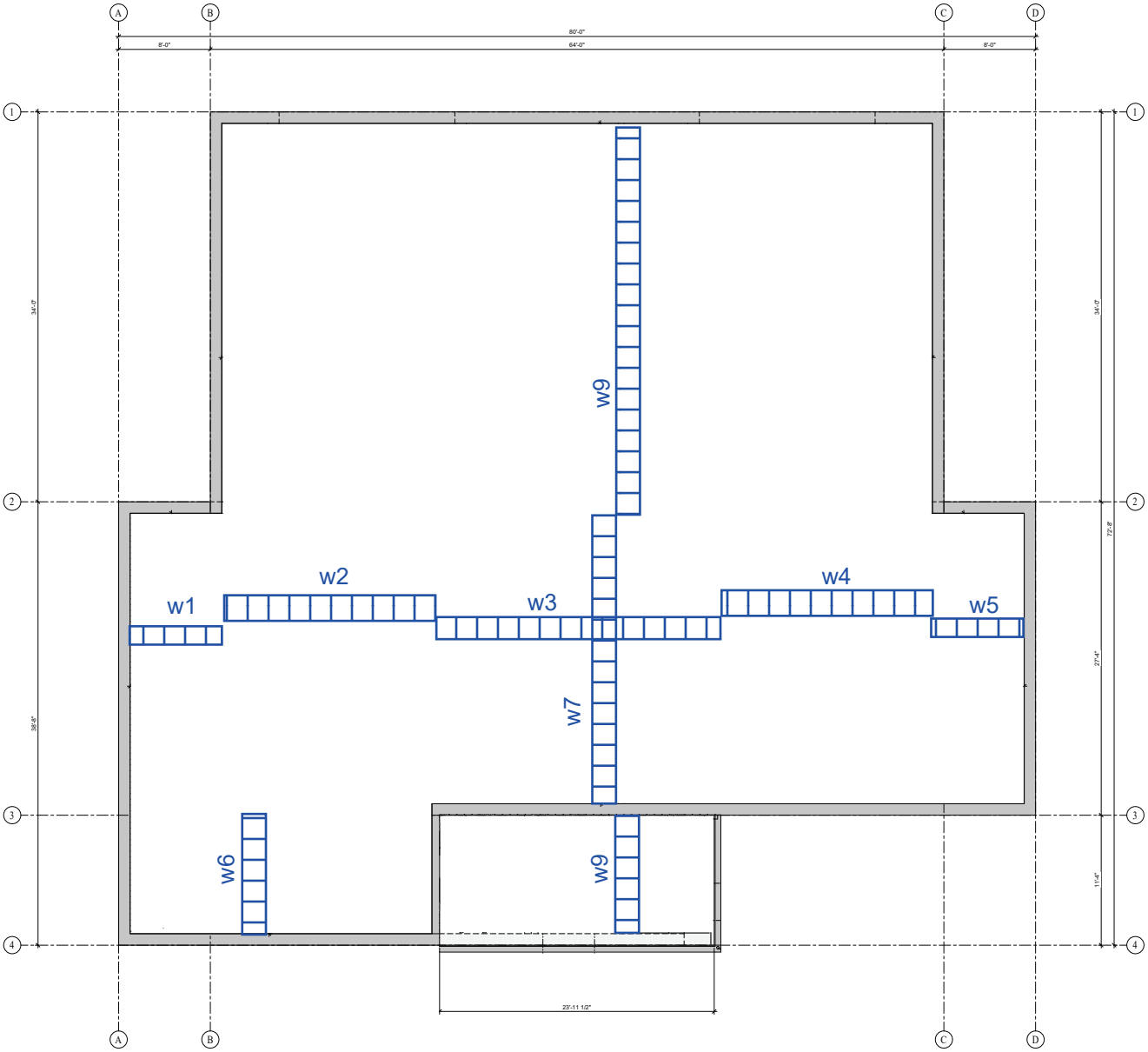
Ref. ASCE 7-22, Fig. 28.3-1

	Vertical Surfaces										
Building Surface	1	4	1E	4E	5	6	5E	6E	Windward Parapet	Leeward Parapet	
Pressure	*21.1*	*-22.9*	*29*	*-24*	*0*	*0*	*0*	*0*	*54.6*	*-36.4*	Total Horiz. Load (plf)
Uniform Load, w	Vertical Trib (ft)										
1			*15*	*16*					*4*	*3*	**1147**
2			*16*	*15*					*4*	*4*	**1188**
3	*16*	*15*							*4*	*4*	**1045**
4			*15*	*15*					*4*	*4*	**1159**
5	*16*	*16*							*4*	*4*	**1068**
6			*16*	*16*					*4*	*4*	**1212**
											0
											0

MWFRS WIND DIAPHRAGM REACTIONS (1.0W)



SEISMIC LOADS (1.0Qe)





Uniform Seismic Loads For Diaphragm and Horizontal Distribution Analysis

Base Shear Coefficient

Cs	***0.34***

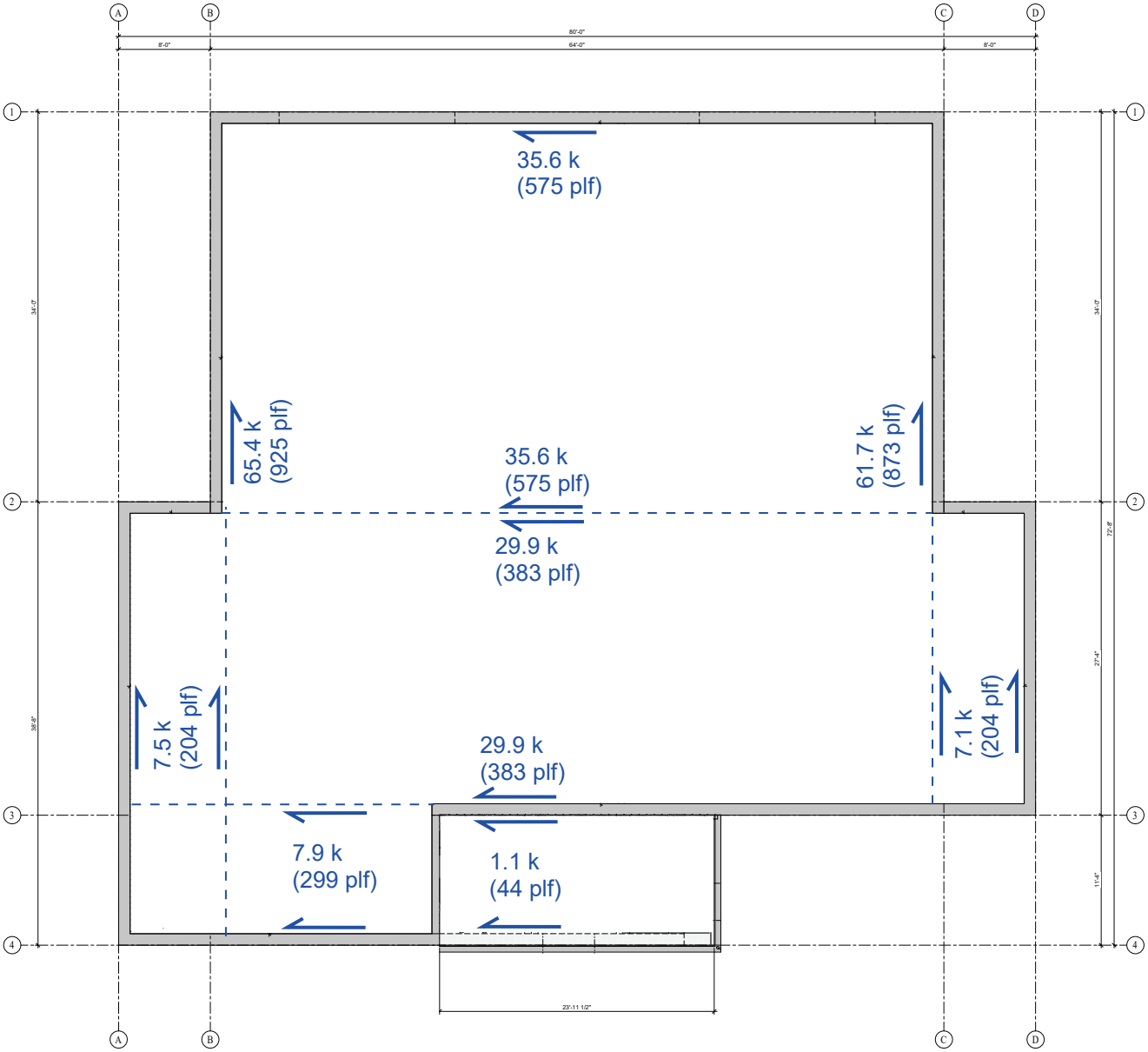
Unit Masses

8" CMU	***80***	psf
12" CMU	***120***	psf
Roof	***25***	psf

Seismic Forces on Diaphragm

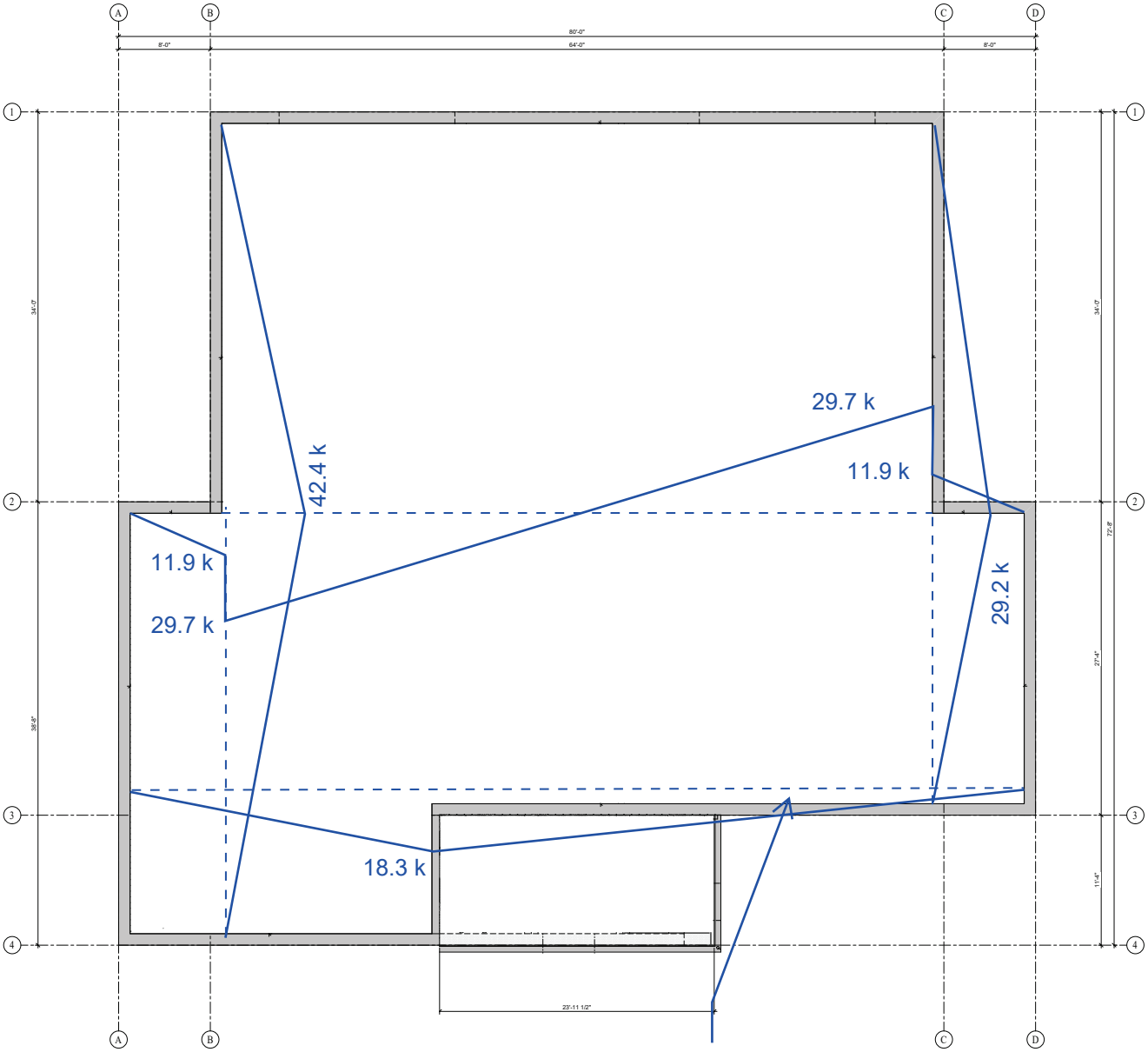
i	Tributary Widths (ft)			Seismic Mass, W (plf)	$1.0Q_E$ Seismic Force, V=CsW (plf)
	8" CMU	12" CMU	Roof		
1		***38***	***38***	5510	1873
2		***39***	***72***	6480	2203
3		***43***	***67***	6835	2324
4		***39***	***61***	6205	2110
5		***38***	***26***	5210	1771
6	***19***	***19***	***27***	4475	1522
7		***38***	***78***	6510	2213
8		***40***	***62***	6350	2159
9			***24***	600	204
10				0	0
11				0	0
12				0	0

SEISMIC DIAPHRAGM REACTIONS, Fx AND Fpx



BY COMPARISON TO WIND LOAD REACTIONS, SEISMIC CONTROLS THE LATERAL DESIGN

SEISMIC COLLECTOR FORCES (1.0Qe U.N.O.)



MAX DIAPHRAGM SHEAR AT COLLECTOR TRANSFER (ΩE/1.2)
= 2(0.383 KLF + 18.3K/52.7')/1.2 = 1.22 KLF



Seismic Loads on Self-Weight of Walls

General Information

C_s	***0.34***
ρ	***1.0***
Wall Mass	***120*** psf

Load Calculation

Location	L (ft)	H (ft)	Mass (k)	E_{hi} (k)	$0.7E_{hi}$ (k)
A	***38.7***	***36***	167.2	56.8	**39.8**
B	***35***	***38***	159.6	54.3	**38.0**
C	***35***	***38***	159.6	54.3	**38.0**
D	***37.3***	***36***	161.1	54.8	**38.4**
1	***64***	***38***	291.8	99.2	**69.5**
2	***22.7***	***36***	98.1	33.3	**23.3**
3	***52.7***	***36***	227.7	77.4	**54.2**
4	***49.33***	***28***	165.7	56.4	**39.4**
B.3	***10.3***	***24***	29.7	10.1	**7.1**
			0.0	0.0	**0.0**
			0.0	0.0	**0.0**
			0.0	0.0	**0.0**
			0.0	0.0	**0.0**
			0.0	0.0	**0.0**

Roof Deck Design

Description: ***3.5DS-24, 18 Ga Typical Deck at Architecturally Exposed Locations***

Uniform Vertical Loads (Load Case)

Dead (D)	***20***	psf
Snow (S)	***73***	psf
Wind Down (W)	***17.5***	psf
Wind Uplift (W)	***90***	psf

Uniform Vertical Loads (Load Combinations)

D+0.7S	***71.1***	psf
D+0.6W_{dn}	***30.5***	psf
D+0.75(.7S+0.6W_{dn})	***66.2***	psf
Max	***71.1***	psf

Max Roving Load/Flute

Dead	***150***	lbs

Max Seismic Anchorage Load

1.0 E)	***2631***	plf

Span Information

Max Span	***8***	ft
Cont. Spans	***2***	Min

Lateral Loads

Max Diaph. Shear	***1220***	plf (1.0E or 1.0W)
Max Collector Shear	***1220***	plf (1.0E or1.0W), per row of connections

Use (Min):

Deck	***Verco 18 Ga 3.5DS-24 galvanized roof deck per IAPMO ER-0652***
Perpendular Conn. Pattern- End	***Hilti X-ENP19 PAF at 24/6***
Perpendicular Conn. Pattern - Interior	***Hilti X-ENP19 PAF at 24/6***
Sidelap Conn.	***#12 Screws at 12" o.c.***
Connection at Parallel Chords and Collectors	***Hilti X-ENP19 PAF at 11" o.c. Max Spacing***

Checks:

Maximum Allowable Uniform Load (ASD)	***269*** psf	≥	71.1 psf	**, OK**
Maximum Allowable Service Load (ASD) for L/240	***716*** psf	≥	71.1 psf	**, OK**
Maximum Allowable Roving Load (ASD)	***770*** lbs	≥	150 lbs	**, OK**
Anchorage Code Check	***0.7***	≤	1	**, OK**
Allowable Diaphragm Shear, ΦSn	***1396*** plf	≥	1220 lbs	**, OK**
Allowable Collector Shear/Row, ΦSn	***1396*** plf	≥	1220 lbs	**, OK**

18 ga 3.5DS-24 AC Grade 50

Bare Deck Inward and Outward Uniform Load

Calculated in accordance with IAPMO ER-0423, AISI S100-16 (2020) w/S2-20

Hilti X-ENP19 PAF Connections to Supports
24 / 3 Perpendicular Connection Pattern to Supports
A36 Support Member or Equivalent
0.25 ≤ Support Thickness (in.) ≤ ∞

End Bearing Length of 2 in.
Interior Bearing Length of 3 in.
L/240 Deflection Limit
Sheet lengths are limited to 42 ft

End Connection Pattern



Interior Connection Pattern



Inward Uniform LRFD Design Load Table (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
1	601	460	364	295	243	205	174	150	131
2	458	401	356	295	244	206	176	152	132
3	520	455	405	364	304	256	219	189	-

Inward Uniform ASD Design Load Table (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
1	400	306	242	196	162	136	116	100	87
2	308	269	239	196	163	137	117	101	88
3	350	306	272	243	202	170	145	126	-

Inward Uniform SERVICE Design Load Table, L/240 Deflection Limit (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
1	442	296	208	152	114	88	69	55	45
2	1069	716	503	367	275	212	167	134	109
3	837	561	394	287	216	166	131	105	-

Outward Uniform LRFD Design Load Controlled by Panel Strength Table (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
1	612	468	370	300	248	208	177	153	133
2	583	449	357	290	240	202	173	149	130
3	719	556	442	360	299	252	215	186	-

Outward Uniform LRFD Design Load Controlled by Connection Strength Table (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
1	502	439	390	351	319	293	270	251	234
2	201	176	156	141	128	117	108	100	94
3	228	200	177	160	145	133	123	114	-

Outward Uniform SERVICE Design Load Table, L/240 Deflection Limit (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
1	444	297	209	152	114	88	69	55	45
2	1065	713	501	365	274	211	166	133	108
3	834	559	393	286	215	166	130	104	-

SDI Construction Span

Point Load	Uniform Load	Span Condition		
(lb)	(psf)	1 Span	2 Span	3 Span
200.0	20.0	29'-10"	30'-1"	31'-1"

Strength Properties

Property	LRFD			ASD		
Positive Bending Strength	$\phi_b \cdot M_{n+}$ =	3.682	k-ft/ft	M_{n+} / Ω_b =	2.450	k-ft/ft
Negative Bending Strength	$\phi_b \cdot M_{n-}$ =	3.746	k-ft/ft	M_{n-} / Ω_b=	2.492	k-ft/ft
Vertical Web Shear Strength	$\Phi_v \cdot V_n$ =	10.356	kips/ft	V_n / Ω_v =	6.813	kips/ft
Vertical Shear, Normal Position (Cell Deck only)	$\phi \cdot V_{nn}$ =	-	kips/ft	V_{nn} / Ω =	-	kips/ft
Vertical Shear, Inverted Position (Cell Deck only)	$\phi \cdot V_{ni}$ =	-	kips/ft	V_{ni} / Ω =	-	kips/ft
End Web Crippling Strength (2 in. bearing)	$\phi_w \cdot P_{ne1}$ =	2.241	kips/ft	P_{ne1} / Ω_w=	1.465	kips/ft
Interior Web Crippling Strength (3 in. bearing)	$\phi_w \cdot P_{ni1}$ =	4.007	kips/ft	P_{ni1} / Ω_w=	2.694	kips/ft

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18 ga 3.5DS-24 AC Grade 50

Bare Deck Variable Position Concentrated Load (VPCL)

Detailed Analysis for Span Length of 8 ft

Calculated in accordance with IAPMO ER-0423, AISI S100-16 (2020) w/S2-20, IBC 2024, ASCE 7-22

Hilti X-ENP19 PAF Connections to Supports	End Bearing Length of 2 in.
24 / 3 Perpendicular Connection Pattern to Supports	Interior Bearing Length of 3 in.
A36 Support Member or Equivalent	End Condition: Both Ends Butted
0.25 ≤ Support Thickness (in.) ≤ ∞	L/240 Deflection Limit

Summary

Variable Position Concentrated Load (VPCL) refers to single or multiple concentrated loads that can be applied at any position along the span.
The maximum magnitude of the VPCL is determined using the governing effect at the critical section, regardless of the actual applied load location(s).
The sum of all applied concentrated loads per rib in a given span shall not exceed the Total VPCL unless shown by more detailed analysis.

Span		L_v =	8.000	ft
Deflection Criteria			L/240	
Inward Roving Load				
	Total VPCL for All LRFD Load Combinations		952	lb/rib
	Total VPCL for Live Service Load		952	lb/rib
	Total VPCL for Roof Live Service Load		920	lb/rib
	Total VPCL for Snow Service Load		770	lb/rib
	Total VPCL for Wind Service Load		952	lb/rib
Outward Roving Load				
	Total VPCL for All LRFD Load Combinations		248	lb/rib
	Total VPCL for Live Service Load		248	lb/rib
	Total VPCL for Roof Live Service Load		248	lb/rib
	Total VPCL for Snow Service Load		248	lb/rib
	Total VPCL for Wind Service Load		248	lb/rib

Design Properties

L_v =	8.000	ft	E =	29,500,000	psi	N_e =	2.000	in.
D_d =	3.500	in.	I_{d+} =	2.313	in^4/ft	N_i =	3.000	in.
d =	8.000	in.	I_{d-} =	2.321	in^4/ft	Δ = L/240 =	0.4	in.

Fastener Strength Properties

Fastener:	Hilti X-ENP19 PAF			
$\phi \cdot P_{tf}$ =	1,171	lb		
$\phi \cdot P_{tf\,ext}$ =	1,757	lb/ft	N_{ext} =	1.500 fasteners /ft
$\phi \cdot P_{tf\,int}$ =	1,757	lb/ft	N_{int} =	1.500 fasteners /ft

Panel Strength Properties

Positive Bending Strength			Negative Bending Strength		
$\phi_b \cdot M_{n+}$ =	3,682	lb-ft/ft	$\phi_b \cdot M_{n-}$ =	3,746	lb-ft/ft

Web Shear Strength		
$\phi_v \cdot V_n$ =	10,356	lb/ft

End Web Crippling Strength			Interior Web Crippling Strength		
$\phi_w \cdot P_{ne1}$ =	2,241	lb/ft	$\phi_w \cdot P_{ni1}$ =	4,007	lb/ft

Vertical Shear, Normal Position (Cell Deck only)			Vertical Shear, Inverted Position (Cell Deck only)		
$\phi \cdot V_{nn}$ =	-	lb/ft	$\phi \cdot V_{ni}$ =	-	lb/ft

Self-Weight

	w_d =	4.200	psf

Loads

Superimposed Dead Load	D =	20.00	psf
Live Load	L =	0.00	psf
Roof Live Load	L_r =	20.00	psf
Snow Load	S =	65.00	psf
Rain Load	R =	0.00	psf
Inward Wind Load (Components and Cladding)	W_{in} =	18.00	psf
Outward Wind Load for Panel (Components and Cladding)	W_{out} =	90.00	psf
Outward Wind Load for Connections (Components and Cladding)	$W_{out,c}$ =	123.00	psf
Inward Tornado Load	$W_{T\,in}$ =	0.00	psf
Outward Tornado Load	$W_{T\,out}$ =	0.00	psf

Basic Load Combinations

Inward Design					
$LC1a_{in}$	$1.4(D + w_d)$ =	33.88	psf	[ASCE 7 Eqn 2.3.1.1a]
$LC2a_{in}$	$1.2(D + w_d) + 1.6L + \max(0.5L_r, 0.3S, 0.5R)$ =	48.54	psf	[ASCE 7 Eqn 2.3.1.2a]
$LC3a_{in}$	$1.2(D + w_d) + \max(1.6L_r, S, 1.6R) + \max(L, 0.5W_{in})$ =	103.04	psf	[ASCE 7 Eqn 2.3.1.3a]
$LC4a_{in}$	$1.2(D + w_d) + \max(W_{in}, W_{T\,in}) + L + \max(0.5L_r, 0.3S, 0.5R)$ =	66.54	psf	[ASCE 7 Eqn 2.3.1.4a]
$LC5a_{in}$	$0.9(D + w_d) + \max(W_{in}, W_{T\,in})$ =	39.78	psf	[ASCE 7 Eqn 2.3.1.5a]
Outward Panel Design				
$LC1a_{out}$	$1.4(D + w_d)$ =	33.88	psf	[ASCE 7 Eqn 2.3.1.1a]
$LC2a_{out}$	$1.2(D + w_d) + 1.6L + \min(0.5L_r, 0.3S, 0.5R)$ =	29.04	psf	[ASCE 7 Eqn 2.3.1.2a]
$LC3a_{out}$	$1.2(D + w_d) + \min(1.6L_r, S, 1.6R) - 0.5W_{out}$ =	-15.96	psf	[ASCE 7 Eqn 2.3.1.3a]
$LC4a_{out}$	$1.2(D + w_d) - \max(W_{out}, W_{T\,out}) + L + \min(0.5L_r, 0.3S, 0.5R)$ =	-41.46	psf	[ASCE 7 Eqn 2.3.1.4a]
$LC5a_{out}$	$0.9(D + w_d) - \max(W_{out}, W_{T\,out})$ =	-68.22	psf	[ASCE 7 Eqn 2.3.1.5a]

Outward Connection Design

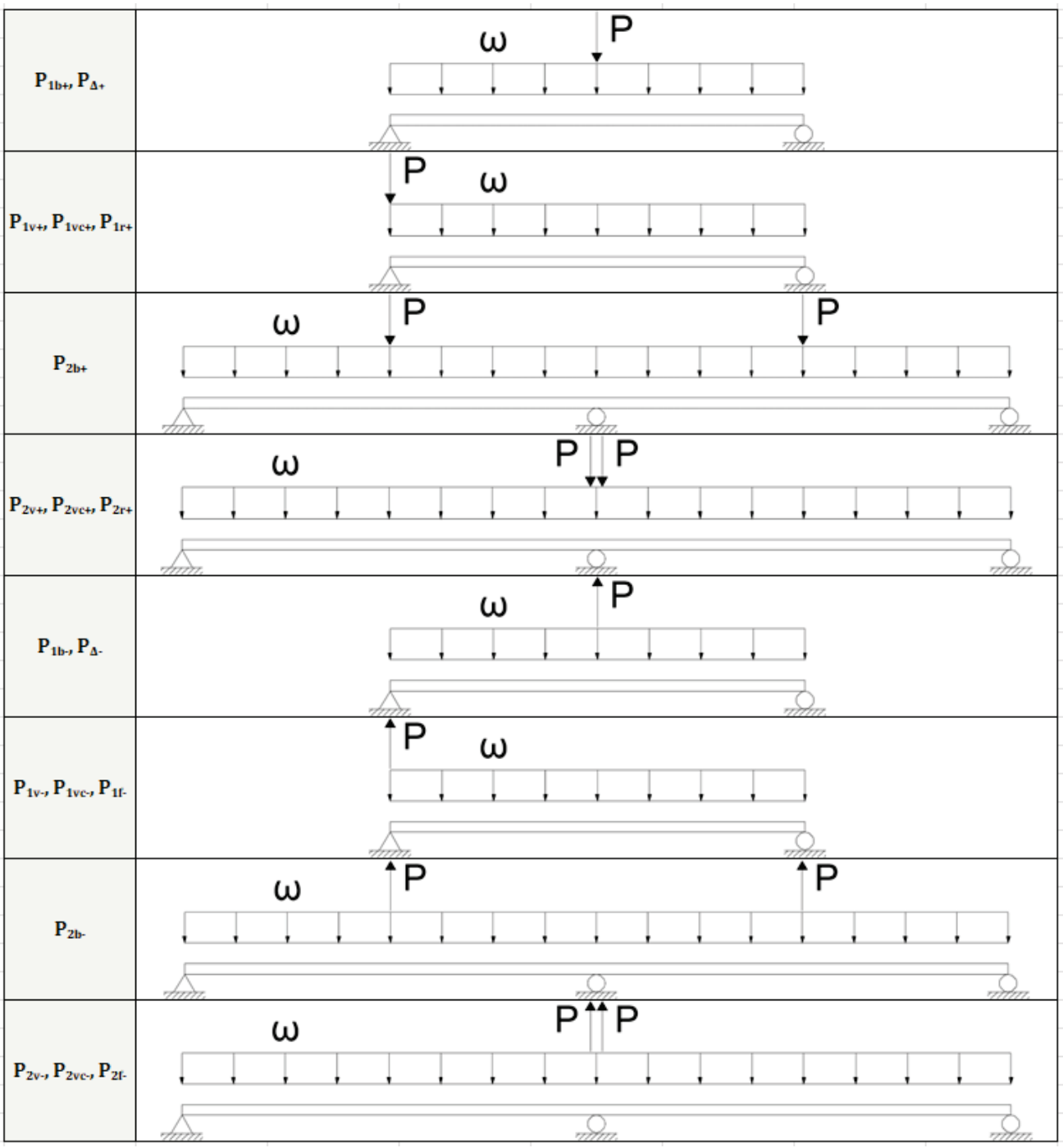
$LC1a_{out,c}$	$1.4(D + w_d)$ =	33.88	psf	[ASCE 7 Eqn 2.3.1.1a]
$LC2a_{out,c}$	$1.2(D + w_d) + 1.6L + \min(0.5L_r, 0.3S, 0.5R)$ =	29.04	psf	[ASCE 7 Eqn 2.3.1.2a]
$LC3a_{out,c}$	$1.2(D + w_d) + \min(1.6L_r, S, 1.6R) - 0.5W_{out,c}$ =	-32.46	psf	[ASCE 7 Eqn 2.3.1.3a]
$LC4a_{out,c}$	$1.2(D + w_d) - W_{out,c} + L + \min(0.5L_r, 0.3S, 0.5R)$ =	-74.46	psf	[ASCE 7 Eqn 2.3.1.4a]
$LC5a_{out,c}$	$0.9(D + w_d) - W_{out,c}$ =	-101.22	psf	[ASCE 7 Eqn 2.3.1.5a]

Basic Load Combinations with Seismic Effects

Design spectral response acceleration parameter at short periods	S_{DS} =	1.340		
Vertical seismic load effect	$E_v = 0.2 \cdot S_{DS} \cdot (D + w_d)$ =	6.49	psf	[ASCE 7 Eqn 12.4-4a]
Inward Design				
$LC6_{in}$	$1.2(D + w_d) + E_v + E_h + L + 0.15S$ =	45.28	psf	[ASCE 7 Eqn 2.3.6.6]
$LC7_{in}$	$0.9(D + w_d) + E_v + E_h$ =	28.27	psf	[ASCE 7 Eqn 2.3.6.7]
Outward Design				
$LC6_{out}$	$1.2(D + w_d) - E_v + E_h + 0.5L + 0.15S$ =	32.30	psf	[ASCE 7 Eqn 2.3.6.6]
$LC7_{out}$	$0.9(D + w_d) - E_v + E_h$ =	15.29	psf	[ASCE 7 Eqn 2.3.6.7]

Service Load Combinations

Inward Design			
SLC L_{in}	$1.0L$ =	0.00	[IBC Tbl 1604.3]
SLC Lr_{in}	$1.0L_r$ =	20.00	[IBC Tbl 1604.3]
SLC S_{in}	$1.0S$ =	65.00	[IBC Tbl 1604.3]
SLC W_{in}	$0.42W_{in}$ =	7.56	[IBC Tbl 1604.3]
Outward Design			
SLC L_{out}	$1.0L$ =	0.00	[IBC Tbl 1604.3]
SLC L_{rout}	$1.0L_r$ =	20.00	[IBC Tbl 1604.3]
SLC S_{out}	$1.0S$ =	65.00	[IBC Tbl 1604.3]
SLC W_{out}	$-0.42W_{out}$ =	-37.80	[IBC Tbl 1604.3]


P1b+, PΔ+
ω
P
P1v+, P1vc+, P1r+
ω
P
P2b+
ω
P
P
P2v+, P2vc+, P2r+
ω
P
P
P1b-, PΔ-
ω
P
P1v-, P1vc-, P1f-
ω
P
P2b-
ω
P
P
P2v-, P2vc-, P2f-
ω
P
P

Inward Roving Load (Strength)

Load Combination:	$LC1a_{in}$	$LC2a_{in}$	$LC3a_{in}$	$LC4a_{in}$	$LC5a_{in}$	$LC6_{in}$	$LC7_{in}$	
ω =	33.88	48.54	103.04	66.54	39.78	45.28	28.27	psf
$P_{1b+} = \frac{4}{L_v} \cdot \left(\phi_b \cdot M_{n+} - \frac{\omega \cdot {L_v}^2}{8} \right) =$	1,705	1,646	1,428	1,574	1,681	1,659	1,727	lb/ft
$P_{1v+} = \phi_v \cdot V_n - \frac{\omega \cdot L_v}{2} =$	10,220	10,161	9,943	10,089	10,196	10,174	10,242	lb/ft
$P_{1vc+} = \phi \cdot V_{nn} - \frac{\omega \cdot L_v}{2} =$	-	-	-	-	-	-	-	lb/ft
$P_{1r+} = \phi_w \cdot P_{ne1} - \frac{\omega \cdot L_v}{2} =$	2,105	2,046	1,828	1,974	2,081	2,059	2,127	lb/ft
$P_{2b+} = \frac{16}{3 \cdot L_v} \cdot \left(\phi_b \cdot M_{n-} - \frac{\omega \cdot {L_v}^2}{8} \right) =$	2,316	2,238	1,947	2,142	2,285	2,255	2,346	lb/ft
$P_{2v+} = \frac{\phi_v \cdot V_n}{2} - \frac{5 \cdot \omega \cdot L_v}{16} =$	5,093	5,056	4,920	5,011	5,078	5,064	5,107	lb/ft
$P_{2vc+} = \frac{\phi \cdot V_{ni}}{2} - \frac{5 \cdot \omega \cdot L_v}{16} =$	-	-	-	-	-	-	-	lb/ft
$P_{2r+} = \frac{\phi_w \cdot P_{ni1}}{2} - \frac{10 \cdot \omega \cdot L_v}{16} =$	1,834	1,760	1,488	1,670	1,804	1,777	1,862	lb/ft
min =	1,705	1,646	1,428	1,574	1,681	1,659	1,727	lb/ft
min =	1,136	1,097	952	1,049	1,120	1,106	1,151	lb/rib

Inward Roving Load (Serviceability)

Load Type:	L	Lr	S	W	
Service Load Combination:	$SLC_{L\,in}$	$SLC_{Lr\,in}$	$SLC_{S\,in}$	$SLC_{W\,in}$	
ω =	0.00	20.00	65.00	7.56	psf
$P_{\Delta+} = \Delta \cdot \frac{48 \cdot E \cdot I_{d+}}{L^3} - \frac{5 \cdot \omega \cdot L}{8} =$	1,480	1,380	1,155	1,442	lb/ft
P_Δ =	986	920	770	961	lb/rib

Outward Roving Load (Strength)

Load Combination:		$LC1a_{out}$	$LC2a_{out}$	$LC3a_{out}$	$LC4a_{out}$	$LC5a_{out}$	$LC6_{out}$	$LC7_{out}$	
Panel	ω =	33.88	29.04	-15.96	-41.46	-68.22	32.30	15.29	psf
Connection	ω =	33.88	29.04	-32.46	-74.46	-101.22	32.30	15.29	psf
$P_{1b-} = \frac{4}{L_v} \cdot \left(\phi_b \cdot M_{n-} + \frac{\omega \cdot {L_v}^2}{8} \right) =$		2,008	1,989	1,809	1,707	1,600	2,002	1,934	lb/ft
$P_{1v-} = \phi_v \cdot V_n + \frac{\omega \cdot L_v}{2} =$		10,491	10,472	10,292	10,190	10,083	10,485	10,417	lb/ft
$P_{1vc-} = \phi \cdot V_{ni} + \frac{\omega \cdot L_v}{2} =$		-	-	-	-	-	-	-	lb/ft
$P_{1f-} = \phi \cdot P_{tf\,ext} + \frac{\omega \cdot L_v}{2} =$		1,892	1,872	1,692	1,590	1,483	1,885	1,817	lb/ft
$P_{2b-} = \frac{16}{3 \cdot L_v} \cdot \left(\phi_b \cdot M_{n+} + \frac{\omega \cdot {L_v}^2}{8} \right) =$		2,635	2,609	2,369	2,233	2,090	2,626	2,536	lb/ft
$P_{2v-} = \frac{\phi_v \cdot V_n}{2} + \frac{5 \cdot \omega \cdot L_v}{16} =$		5,262	5,250	5,138	5,074	5,007	5,258	5,216	lb/ft
$P_{2vc-} = \frac{\phi \cdot V_{nn}}{2} + \frac{5 \cdot \omega \cdot L_v}{16} =$		-	-	-	-	-	-	-	lb/ft
$P_{2f-} = \frac{\phi \cdot P_{tf\,int}}{2} + \frac{10 \cdot \omega \cdot L_v}{16} =$		1,047	1,023	716	506	372	1,040	954	lb/ft
	min =	1,047	1,023	716	506	372	1,040	954	lb/ft
	min =	698	682	477	337	248	693	636	lb/rib

Outward Roving Load (Serviceability)

Load Type:		L	Lr	S	W	
Service Load Combination:		$SLC_{L\,in}$	$SLC_{Lr\,in}$	$SLC_{S\,in}$	$SLC_{W\,out}$	
	ω =	0.00	20.00	65.00	-37.80	psf
$P_{\Delta-} = \Delta \cdot \frac{48 \cdot E \cdot I_{d-}}{L^3} + \frac{5 \cdot \omega \cdot L}{8} =$		1,485	1,585	1,810	1,296	lb/ft
	P_Δ =	990	1,056	1,206	864	lb/rib

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18 ga 3.5DS-24 AC Grade 50

Hilti X-ENP19 PAF Connection to Support

Shear Strength, Tension Strength, Stiffness

Detailed Analysis for Span Length of 8 ft

Calculated in accordance with IAPMO ER-0423, AISI S100-16 (2020) w/S2-20, AISI S310-20 w/S1-22

For Tension/Shear Interaction, MWFRS Design Net Wind Uplift (LRFD) = 90 psf
A36 Support Member or Equivalent
0.25 ≤ Support Thickness (in.) ≤ ∞

Steel Deck Properties

t_1 =	0.0478	in.
t_{1c} =	0.0478	in.
F_{y1} =	50.0	ksi
F_{u1} =	65.0	ksi

Support Steel Properties

t_2 =	0.250	in.
F_{y2} =	36.0	ksi
F_{u2} =	58.0	ksi

Perforation Adjustment Factor [ER-0423]

ρ =	0.712	Shear
ρ =	0.850	Pullover
ρ =	1.150	Flexibility

Fastener Properties [ER-0423]

d =	0.177	in.
d_w =	0.591	in.

Shear Strength

Material		P_{nvp} =	3.838	kips	[ER-0423]
		ϕ_{nvp} =	0.60		[ER-0423]
		$\phi_{nvp} \cdot P_{nvp}$ =	2.303	kips	
Typical Condition	$P_{nf} = \rho \cdot 56 \cdot t_1 \cdot (1 - t_1)$ =		1.815	kips	[ER-0423 Eqn H-1]
		ϕ_{nf} =	0.70		[ER-0423]
		$\phi_{nf} \cdot P_{nf}$ =	1.271	kips	
		$\min(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nf})$ =	1.271	kips	
		$P_{nf} \le P_{nvp}$ =	1.815	kips	
Corner Condition	$P_{nfc} = \rho \cdot 56 \cdot t_{1c} \cdot (1 - t_{1c})$ =		1.815	kips	[ER-0423 Eqn H-1]
		$\phi_{nf} \cdot P_{nfc}$ =	1.271	kips	
		$\min(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nfc})$ =	1.271	kips	
		$P_{nfc} \le P_{nvp}$ =	1.815	kips	

Flexibility

$S_f = \rho \cdot \frac{0.75}{1000 \cdot \sqrt{t_1}}$ =	0.0039	in./kip	[ER-0423 Eqn H-3a]

Tension Strength

Material	P_{nts} =	6.397	kips	[ER-0423]
	ϕ_t =	0.60		[ER-0423]
	$\phi_t \cdot P_{nts}$ =	3.838	kips	
Pull-out	P_{not}=	2.625		[ER-0423 Eqn H-5]
	ϕ_{not} =	0.65		[ER-0423 Eq H-5]
	$\phi_{not} \cdot P_{not}$ =	1.706	kips	
Pullover - Typical Condition	$P_{nov} = \rho \cdot 1.5 \cdot t_1 \cdot d_w \cdot F_{u1}$ =	2.341	kips	[S100 Eqn J5.2.3-1]
	ϕ_{tov} =	0.50		
	$\phi_{tov} \cdot P_{nov}$ =	1.171	kips	
	$\phi \cdot P_{tf} = \min(\phi_t \cdot P_{nts}, \phi_{not} \cdot P_{not}, \phi_{nov} \cdot P_{nov})$ =	1.171	kips	
Pullover - Corner Condition	$P_{novc} = \rho \cdot 1.5 \cdot t_{1c} \cdot d_w \cdot F_{u1}$ =	2.341	kips	[S100 Eqn J5.2.3-1]
	$\phi_{tov} \cdot P_{novc}$ =	1.171	kips	
	$\min(\phi_t \cdot P_{nts}, \phi_{not} \cdot P_{not}, \phi_{nov} \cdot P_{novc})$ =	1.171	kips	

Tension and Shear Interaction

Required Tensile Strength of Connection (T)	T =	0.600	kips	
Combined Shear and Pullout - Typical Condition	$P_{nft} = P_{nf} \cdot \left(1 - \frac{T}{\phi_{tot} \cdot P_{not}}\right)$ =	1.177	kips	[S310 Eqn D3.1.3-1b]
Combined Shear and Pullout - Corner Condition	$P_{nftc} = P_{nfc} \cdot \left(1 - \frac{T}{\phi_{tot} \cdot P_{not}}\right)$ =	1.177	kips	[S310 Eqn D3.1.3-1b]
Combined Shear and Pullover - Typical Condition	$P_{nft} = P_{nf} \cdot \left(1 - \frac{T}{\phi_{tov} \cdot P_{nov}}\right)$ =	0.885	kips	[S310 Eqn D3.1.3-1b]
Combined Shear and Pullover - Corner Condition	$P_{nftc} = P_{nfc} \cdot \left(1 - \frac{T}{\phi_{tov} \cdot P_{novc}}\right)$ =	0.885	kips	[S310 Eqn D3.1.3-1b]
Residual Shear Strength - Typical Condition	P_{nft} =	0.885	kips	[S310 Eqn D3.1.3-1b]
Residual Shear Strength - Corner Condition	P_{nftc} =	0.885	kips	[S310 Eqn D3.1.3-1b]

Required End Distance Governed by Rupture

Typical Condition	$e_{di} = \frac{\min(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nf})}{\phi_{nv} \cdot 2 \cdot F_{u1} \cdot t_1} + \frac{d}{2}$ =	0.429	in.	[ER-0423 Eqn R-1]
	ϕ_{nv} =	0.60		[ER-0423 Eqn R-1]
Corner Condition	$e_{dc} = \frac{\min(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nfc})}{\phi_{nv} \cdot 2 \cdot F_{u1} \cdot t_{1c}} + \frac{d}{2}$ =	0.429	in.	[ER-0423 Eqn R-1]

Minimum End Bearing Length Governed by Material and Fasteners

Minimum distance between fastener and end of deck

$e_d = \max(e_{di}, e_{dc}) =$ 0.429 in.

Minimum distance between fastener and end of support limited by rupture

For design, $t_2 \le 3/16$ in. $t_{2\,max} =$ 0.1875 in. [S100 Sec J6]

$$e_{si} = \frac{\min(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nf})}{\phi_{nv} \cdot 0.6 \cdot F_{u2} \cdot 2 \cdot t_2} + \frac{d}{2} =$$ 0.283 in. [S100 Eqn J6.1-1]

$\phi_{nv} =$ 0.50 [S100 Tbl J6-1]

$$e_{sc} = \frac{\min(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nfc})}{\phi_{nv} \cdot 0.6 \cdot F_{u2} \cdot 2 \cdot t_2} + \frac{d}{2} =$$ 0.283 in. [S100 Eqn J6.1-1]

$e_s = \max(e_{si}, e_{sc}) \ge 0.500 =$ 0.500 in.

Minimum spacing between fasteners $s_{min} =$ 1.000 in.

For a single row of fasteners $N_{e\,min} = e_d + e_s =$ 0.929 in.

For a double row of fasteners $N_{e\,min} = e_d + s_{min} + e_s =$ 1.929 in.

Minimum Interior Bearing Length Governed by Material and Fasteners

For a single row of fasteners $N_{i\,min} = 2 \cdot e_s =$ 1.000 in.

For a double row of fasteners $N_{i\,min} = 2 \cdot e_s + s_{min} =$ 2.000 in.

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18 ga 3.5DS-24 AC Grade 50

Detailed Bare Deck Web Crippling Strength Analysis

Calculated in accordance with IAPMO ER-0423, AISI S100-16 (2020) w/S2-20

End Bearing Length of 2 in. Interior Bearing Length of 3 in.

Web Crippling Strength Summary

End One-Flange Loading	$\phi_w \cdot P_{ne1}$ =	2,241	lb/ft
End Two-Flange Loading	$\phi_w \cdot P_{ne2}$ =	2,435	lb/ft
Interior One-Flange Loading	$\phi_w \cdot P_{ni1}$ =	4,007	lb/ft
Interior Two-Flange Loading	$\phi_w \cdot P_{ni2}$ =	4,805	lb/ft

Panel Properties

t =	0.0478	in.	h_w =	3.110		d_p =	0.156	in.
F_y =	50.0	ksi	θ =	70.8	deg	c_p =	0.375	in.
N_e =	2.000	in.	R =	0.188		W_p =	0.000	in.
N_i =	3.000	in.	w_c =	24.000	in.			
			d =	8.000	in.			

Web Crippling Properties

Webs per foot width $n = 2 \cdot (12 / d)$ = 3.000

Web crippling strength of a web, P_n

$$P_n = C \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - C_R \sqrt{\frac{R}{t}}\right)\left(1 + C_N \sqrt{\frac{N}{t}}\right)\left(1 - C_h \sqrt{\frac{h_w}{q_s \cdot t}}\right)$$

[S100 Eqn G5-1 with modifications per ER-0423]

$$p_o = 0.9069 \cdot \frac{{d_p}^2}{{c_p}^2} = 0.157$$ [ER-0423 Eqn W-2]

For $p_o < 0.2$: $k = 1 - 2.175 \cdot p_o$ = 0.659 [ER-0423 Eqn W-3]

For $0.2 \le p_o \le 0.58$: $k = 0.9 + {p_o}^2 - 1.875 \cdot p_o$ = 0.630 [ER-0423 Eqn W-3]

k = 0.659

$$q_s = 1 - (1 - k)\left(\frac{W_p}{h_w}\right) = 1.000$$ [ER-0423 Eqn W-1]

END Bearing Condition			INTERIOR Bearing Condition			
$N_e \geq 0.75$ =	2.000	in. ≤ $N_{e\,max}$	$N_i \geq 0.75$ =	3.000	in. ≤ $N_{i\,max}$	[S100 Eqn G5-1]
$N_{e\,max}$ =	9.33	in.	$N_{i\,max}$ =	9.33	in.	[S100 Tbl G5-5]
One Flange Loading			**One Flange Loading**			
C =	4		C =	8		[S100 Tbl G5-5]
C_R =	0.04		C_R =	0.10		[S100 Tbl G5-5]
C_N =	0.25		C_N =	0.17		[S100 Tbl G5-5]
C_h =	0.025		C_h =	0.004		[S100 Tbl G5-5]
Two Flange Loading			**Two Flange Loading**			
C =	9		C =	10		[S100 Tbl G5-5]
C_R =	0.12		C_R =	0.11		[S100 Tbl G5-5]
C_N =	0.14		C_N =	0.21		[S100 Tbl G5-5]
C_h =	0.040		C_h =	0.020		[S100 Tbl G5-5]
Condition Check			**Condition Check**			
R / t =	3.933	≤ 20	R / t =	3.933	≤ 10	[S100 Tbl G5-5]
h_w / t =	65.063	≤ 200	h_w / t =	65.063	≤ 200	[S100 Tbl G5-5]
N_e / t =	41.841	≤ 210	N_i / t =	62.762	≤ 210	[S100 Tbl G5-5]
N_e / h_w =	0.643	≤ 3	N_i / h_w =	0.965	≤ 3	[S100 Tbl G5-5]
θ =	70.8	≥ 45	θ =	70.8	≥ 45	[S100 Eqn G5-1]
Meets all conditions			Meets all conditions			

$\sqrt{\frac{R}{t}}$ = 1.983 $\sqrt{\frac{N_e}{t}}$ = 6.468 $\sqrt{\frac{N_i}{t}}$ = 7.922 $\sqrt{\frac{h_w}{q_s \cdot t}}$ = 8.066

End Bearing Condition One Flange Loading

$$P_{ne1} = n \cdot 4 \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - 0.04\sqrt{\frac{R}{t}}\right)\left(1 + 0.25\sqrt{\frac{N_e}{t}}\right)\left(1 - 0.025\sqrt{\frac{h_w}{q_s \cdot t}}\right) = 2.49 \text{ kips/ft}$$

ϕ_w = 0.90 [S100 Tbl G5-5]

$\phi_w \cdot P_{ne1}$ = 2.241 kips/ft

End Bearing Condition Two Flange Loading

$$P_{ne2} = n \cdot 9 \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - 0.12\sqrt{\frac{R}{t}}\right)\left(1 + 0.14\sqrt{\frac{N_e}{t}}\right)\left(1 - 0.040\sqrt{\frac{h_w}{q_s \cdot t}}\right) = 2.865 \text{ kips/ft}$$

ϕ_w = 0.85 [S100 Tbl G5-5]

$\phi_w \cdot P_{ne2}$ = 2.435 kips/ft

Interior Bearing Condition One Flange Loading

$$P_{ni1} = n \cdot 8 \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - 0.10\sqrt{\frac{R}{t}}\right)\left(1 + 0.17\sqrt{\frac{N_i}{t}}\right)\left(1 - 0.004\sqrt{\frac{h_w}{q_s \cdot t}}\right) = \quad 4.714 \quad \text{kips/ft}$$

$\phi_w =$ 0.85 [S100 Tbl G5-5]

$\phi_w \cdot P_{ni1} =$ 4.007 kips/ft

Interior Bearing Condition Two Flange Loading

$$P_{ni2} = n \cdot 10 \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - 0.11\sqrt{\frac{R}{t}}\right)\left(1 + 0.21\sqrt{\frac{N_i}{t}}\right)\left(1 - 0.020\sqrt{\frac{h_w}{q_s \cdot t}}\right) = \quad 5.653 \quad \text{kips/ft}$$

$\phi_w =$ 0.85 [S100 Tbl G5-5]

$\phi_w \cdot P_{ni2} =$ 4.805 kips/ft

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18 ga 3.5DS-24 AC Grade 50

Bare Deck Diaphragm Strength Shear Strength and Stiffness

Calculated in accordance with IAPMO ER-0423, AISI S100-16 (2020) w/S2-20, AISI S310-20 w/S1-22

Hilti X-ENP19 PAF Connections to Supports
24 / 6 Perpendicular Connection Pattern to Supports
#12 Screw Sidelap Connection
End Condition: Both Ends Butted

A36 Support Member or Equivalent
0.25 ≤ Support Thickness (in.) ≤ ∞
End Bearing Length of 2 in.
Sheet lengths are limited to 42 ft

End Connection Pattern



Interior Connection Pattern



LRFD Design Seismic Diaphragm Shear Strength $\phi \cdot S_n$ (plf) **2 Span Condition**

Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
4	1396	1396	1396	1396	1396	1396	1396	1396	1396
6	1396	1396	1396	1396	1396	1396	1396	1396	1396
8	1396	1396	1396	1396	1396	1396	1396	1396	1396
12	1119	1093	1072	1055	1042	1030	1021	1012	1005
18	881	883	790	801	811	746	757	768	719
24	757	666	692	625	651	598	622	578	601
36	631	554	494	536	487	447	484	449	420

LRFD Design Combined Wind Uplift and Diaphragm Shear Strength $\phi \cdot S_{nt}$ (plf)

MWFRS Design Net Wind Uplift (LRFD) = 90 psf **2 Span Condition**

Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
4	1396	1396	1396	1396	1396	1396	1396	1396	1396
6	1396	1396	1396	1396	1396	1396	1396	1396	1396
8	1396	1396	1396	1396	1396	1396	1396	1370	1356
12	1192	1158	1130	1106	1085	1065	1046	1028	1010
18	934	934	829	838	845	772	782	788	733
24	797	694	722	646	673	613	637	588	610
36	656	569	500	546	492	446	486	447	414

Seismic or Wind Diaphragm Shear Stiffness, G' (kip/in.) **2 Span Condition**

Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
4	9.9	10.9	11.9	12.8	13.6	14.4	15.2	15.9	16.5
6	9.6	10.6	11.5	12.3	13.1	13.8	14.5	15.1	15.7
8	9.4	10.3	11.2	11.9	12.7	13.3	13.9	14.4	15.0
12	9.1	9.9	10.6	11.3	11.9	12.4	12.9	13.4	13.8
18	8.8	9.5	10.0	10.6	11.2	11.5	12.0	12.4	12.5
24	8.6	9.1	9.8	10.1	10.6	10.8	11.3	11.4	11.9
36	8.3	8.8	9.1	9.7	9.9	10.0	10.5	10.5	10.5

Average Connection Spacing to Supports at Parallel Chords & Collectors (in.)

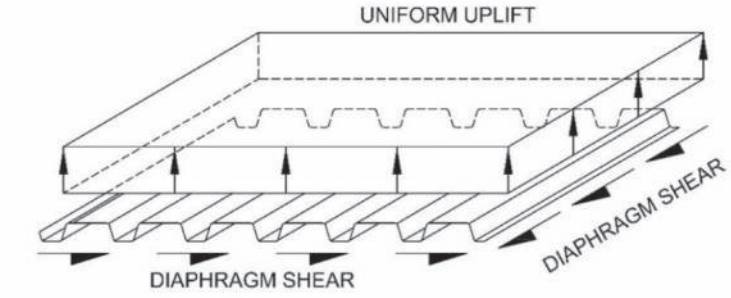
Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
4	6	6	6	7	7	7	7	7	7
6	8	9	8	9	9	8	9	9	9
8	9	11	10	11	10	11	10	11	11
12	14	14	14	15	15	14	16	15	15
18	17	16	18	20	19	21	20	21	23
24	21	24	22	24	22	24	26	28	26
36	28	32	36	30	33	36	31	34	36

Number of Sidelap Connections per Span

Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
4	21	24	27	30	33	36	39	42	45
6	14	16	18	20	22	24	26	28	30
8	11	12	14	15	17	18	20	21	23
12	7	8	9	10	11	12	13	14	15
18	5	6	6	7	8	8	9	10	10
24	4	4	5	5	6	6	7	7	8
36	3	3	3	4	4	4	5	5	5

Note: MWFRS Design Net Wind Uplift (LRFD) = 90 psf

Tables may be limited by fastener tension strength capacity



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Bare Deck Wall Anchorage

18 gage 3.5D-24 Grade 40 with 8' - 0" Deck Span

Project: Libby Booth STEAM
Description: 3.5DS-24 Wall Anchorage

Job No. 0
Engineer: 0

Connections to Support (Ledger/Chord) at WALL

Hilti X-ENP-19 PAF
24/6 Perpendicular Connection Pattern
0.654 in. Steel Deck Minimum End Distance
2.0DS-30 AC

A36 Support Member or Equivalent
0.25 in. ≤ Support Thickness in.
0.50 in. Support Member Minimum Edge Distance
2.00 in. Steel Deck Bearing on Support at Wall

0.00 in. Connection Prying Action for Seismic at Wall
0.00 in. Connection Prying Action for Wind at Wall

Connections in FIELD of Diaphragm

Hilti X-ENP-19 PAF
24/6 Perpendicular Connection Pattern
0.573 in. Steel Deck Minimum End Distance

A36 Support Member or Equivalent
0.25 in. ≤ Support Thickness in.
0.50 in. Support Member Minimum Edge Distance
3.00 in. Steel Deck Bearing on Supports in Field of Diaphragm
2.00 in. Steel Deck Sheet End Bearing on Support in the Field

Summary of Calculations in accordance with ASCE 7-16, AISI S100-16 (2020) w/S2-20, and ER-0423

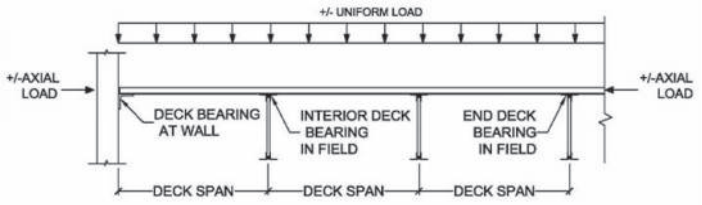
1-Span	Steel Deck Axial and Bending Check	0.37	≤1.0 Pass		
	Connection Strength Check	0.69	≤1.0 Pass at wall	0.69	≤1.0 Pass in field
	Web Crippling Check	0.30	≤1.0 Pass at wall	0.30	≤1.0 Pass in field
2-Span	Steel Deck Axial and Bending Check	0.34	≤1.0 Pass		
	Connection Strength Check	0.70	≤1.0 Pass at wall	0.70	≤1.0 Pass in field
	Web Crippling Check	0.23	≤1.0 Pass at wall	0.41	≤1.0 Pass in field
3-Span	Steel Deck Axial and Bending Check	0.28	≤1.0 Pass		
	Connection Strength Check	0.70	≤1.0 Pass at wall	0.70	≤1.0 Pass in field
	Web Crippling Check	0.24	≤1.0 Pass at wall	0.36	≤1.0 Pass in field

Vertical Loads

Dead Load for Inward Wind Combo, Di (psf)	19.3
Dead Load for Wind Uplift Combo, Do (psf)	19.3
Live Load, L (psf)	0.0
Roof Live Load, Lr (psf)	20.0
Rain Load, R (psf)	0.0
Snow Load, S (psf)	65.0
Inward Wind, W_i (psf)	17.5
Wind Uplift on Steel Deck , Wo (psf)	90.0
Wind Uplift for Connections, Wo (psf)	123.0

Horizontal Loads and Factors

Wall Inward Wind Anchorage Load, Wi (plf)	0
Wall Outward Wind Anchorage Load, Wo (plf)	0
Notional Load for Wall Anchorage, ±N (plf)	0
Seismic Wall Anchorage Load, ±FD (plf)	2631
Seismic Parameter, SDS	1.34
Seismic Design Category	C, D, E or
Wall Construction	Concrete or Masonry
Steel Element of Structural Wall Anchorage System Increase (ASCE 7 Section 12.11.2.2.2)	1.4



Bare Deck Wall Anchorage V2.1.1 Date: 6/30/2026
Based on ASCE 7-16, AISI S100- 16 w/ S2-20 and, IAPMO ER-0423

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Roof Deck Design

Description: ***PLN3-32 18 Ga Typical Deck at Locations Not Architecturally Exposed***

Uniform Vertical Loads (Load Case)

Dead (D)	***20***	psf
Snow (S)	***73***	psf
Wind Down (W)	***17.5***	psf
Wind Uplift (W)	***90***	psf

Uniform Vertical Loads (Load Combinations)

D+0.7S	***71.1***	psf
D+0.6W_{dn}	***30.5***	psf
D+0.75(.7S+0.6W_{dn})	***66.2***	psf
Max	***71.1***	psf

Max Roving Load/Flute

Dead	***150***	lbs

Max Seismic Anchorage Load

1.0 E)	***0***	plf

Span Information

Max Span	***8***	ft
Cont. Spans	***2***	Min

Lateral Loads

Max Diaph. Shear	***44***	plf (1.0E or 1.0W)
Max Collector Shear	***0***	plf (1.0E or1.0W), per row of connections

Use (Min):

Deck	***Verco 18 Ga PLN3-32 galvanized roof deck per IAPMO ER-0652***
Perpendular Conn. Pattern- End	***Hilti X-ENP19 PAF at 32/5***
Perpendicular Conn. Pattern - Interior	***Hilti X-ENP19 PAF at 32/5***
Sidelap Conn.	***#12 Screws at 12" o.c.***
Connection at Parallel Chords and Collectors	***Hilti X-ENP19 PAF at 16" o.c. Max Spacing***

Checks:

Maximum Allowable Uniform Load (ASD)	***222*** lbs	≥	71.1 psf	**, OK**
Maximum Allowable Service Load (ASD) for L/240	***393*** lbs	≥	71.1 psf	**, OK**
Maximum Allowable Roving Load (ASD)	***280*** lbs	≥	150 lbs	**, OK**
Anchorage Code Check	***0***	≤	1	**, OK**
Allowable Diaphragm Shear, ΦSn	***1229*** plf	≥	44 lbs	**, OK**
Allowable Collector Shear/Row, ΦSn	***1229*** plf	≥	0 lbs	**, OK**

18 ga PLN3™-32 Grade 50

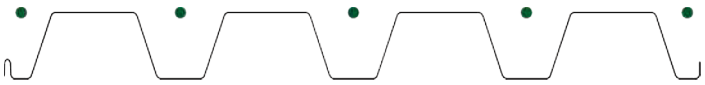
Bare Deck Inward and Outward Uniform Load

C7urm7yaolc 7rriPo7cral kyt IA: MO EF-03wh4AISI Sw33-wR,030311 6S0-03

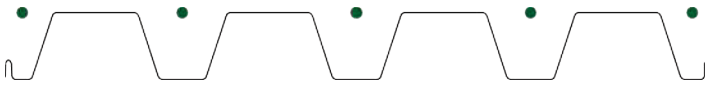
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A/R Sm99iPyMaf gaPi PE. mkb7uacy
3p02f Sm99iPyTtkrecaXX,kcp1f ≤

Eco Ba7Pkcs Lacsyt in0kcp
IcyaPkiPBa7Pkcs Lacsyt in/kcp
L60q3 Vavuarykic Lkf ky
Staayuacsyt X7Paukf kyaoyi q0ny

Eco Ciccarykic : 7yyaPc



IcyaPkiPCiccarykic : 7yyaPc



Inward Uniform LRFD Design Load Table (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
w	qww	/w2	0qh	03w	wRR	wq3	www	w3/	h)
0	q/q	//q	0R2	0w2	w∞h	w23	w0h	ww3	)R
/	200	qw2	/0)	0R∞	00w	whR	w2)	w/∞	-

Inward Uniform ASD Design Load Table (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
w	0∞/	03)	wR2	w/q	www	)/	∞)	Rh	R3
0	0h)	000	w∞R	wq/	wwh	))	h2	∞/	Rq
/	/2w	0∞R	0w)	w∞h	wq∞	w0q	w3R	)w	-

Inward Uniform SERVICE Design Load Table, L/240 Deflection Limit (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
w	0/2	w2∞	www	hw	Rw	q∞	/∞	0)	0q
0	2hR	/)/	0∞R	03w	w2w	wwR	)w	∞/	R3
/	q2)	/3h	0wR	w2∞	wwh	)w	∞0	2∞	-

Outward Uniform LRFD Design Load Controlled by Panel Strength Table (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
w	qq0	//h	0R∞	0w∞	w∞9	w23	w0h	ww3	)R
0	q32	/ww	0qR	033	wR2	w/)	ww)	w30	h)
/	23/	/h∞	/3∞	0q)	03R	w∞/	wqh	w0h	-

Outward Uniform LRFD Design Load Controlled by Connection Strength Table (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
w	/R)	/0/	0h∞	02h	0/2	0w2	w))	whq	w∞0
0	0)2	02h	0/3	03∞	whh	w∞0	w2)	wqh	w/h
/	//2	0)/	0Rw	0/2	0w/	w)R	whw	wRh	-

Outward Uniform SERVICE Design Load Table, L/240 Deflection Limit (psf)

No. of Spans	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
w	0q/	wR/	www	h/	R/	qh	/h	/3	02
0	2RR	/∞9	0RR	w)q	wqR	ww0	hh	∞w	2h
/	qq/	0)∞	03)	w20	www	hh	R)	22	-

SDI Construction Span

Point Load	Uniform Load	Span Condition		
(lb)	(psf)	1 Span	2 Span	3 Span
033p3	03p3	02808	0R8w8	0∞838

Strength Properties

Property	LRFD			ASD		
:iXkykba Bacokcs SyPacsyt	'gφM.n+	0p2wR	e-ny6ny	M.n6=g+	wpR∞q	e-ny6ny
Das7ykba Bacokcs SyPacsyt	'gφM..+	0p∞3∞	e-ny6ny	M..6=g+	wph3w	e-ny6ny
ΩaPykr7uWag Sta7PSyPacsyt	Φbφ1Ωc+	w3p/∞w	el9X6ny	Ωc6=b+	Rph0/	el9X6ny
ΩaPykr7uSta7P4Di Pf 7u:iXkykic,CauuVareicud1	'φΩcc+	-	el9X6ny	Ωcc6=+	-	el9X6ny
ΩaPykr7uSta7P4IcbaPyao:iXkykic,CauuVareicud1	'φΩck+	-	el9X6ny	Ωck6=+	-	el9X6ny
Eco Wag CPl99ukcs SyPacsyt,0kcpga7Pkcs1	'lφ.e1+	0p0RR	el9X6ny	:.e16=l+	wpqhw	el9X6ny
IcyaPki PWag CPl99ukcs SyPacsyt,/kcpga7Pkcs1	'lφ.it+	qp3w∞	el9X6ny	:.it6=l+	0p∞3w	el9X6ny

ΩaPXki c5Ωwp3p3 Bay7

DOTICE5VaXksc oamryXyt 7yrimo r7mXa kcjmPdi Poa7yt f 7d PaXmymPi f Paudkcs i c yt a kcni Pf 7yki c kc yt kXoi rmf acyl kyt i myk coa9acoacybaPkwkr7yki c gd 7. m7ukkao 9Pi maXXki c7up Tt a kcni Pf 7yki c kc yt kXoi rmf acykX9Pi bkoao "AS IS"pDmri PCi P9i P7yki c 7co kyX7nkuk7yaXax9PaXXudokXru7kf 5,kl7cd 7co 7uuPa9PaXacy7yki cX4l 7PP7cykaX7co ri cokyki cX7co,kl7uu d7gkdkyd 7PkXkcs i myi ni PPau7yao yi yt kXoi rmf acy7co yt a kcni Pf 7yki c kc kyp

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Bare Deck Variable Position Concentrated Load (VPCL)

Detailed Analysis for Span Length of 8 ft

C8dfd8lan ov 8rrcPn8vra u dt IA: MO EN-03wh4AISI Sw33-wR,03031u 6S0-034IBC 030(4ASCE)-00

Hodo7-ED: wX: A9 CcvvarlocvFlc SfsscPlF	Evn Ba8Povi Lavilt cg0 ovp
/0 6 2: aPsavnofd8PCcvvarlocv: 8llaPv lc SfsscPlF	IvlaPocPBa8Povi Lavilt cg/ ovp
A/R SfsscPl Ma. maPcPEbfdk8davl	Evn Ccvndocv5Bclt EvnFL8ssan
3p02 q SfsscPl TtorevaFF,ovp1q≤	L60(3 Vaodarlocv Lo d

Sf. . 8Pf

y8Pd8mda: cFdocv CcvravlP8lan Lc8n,y: CL1PagaPFlc Fovi da cP. fdosda rcvravlP8lan dc8nFlt8l r8v ma8ssodan 8l 8vf scFdocv 8dcvi lt a Fs8vp

Tta. 8xo f. . 8ivdfna cglt a y: CLdFnalaP. ovan f Fovi lt a i ckaPvovi aggarl 8l lt a rPdor8dFarlocv4Pai 8PndaFF cglt a 8rlf 8d8ssodan dc8n dcr8locv,F1p

Tta Ff. cg8dl8ssodan rcvravlP8lan dc8nFsaPPomov 8 idkav Fs8v Ft 8ddvcl axraan lt a Tcl8dy: CL f vdaFF Ft cu v mf . cPa nal8odan 8v8d FdFp

Ss8v		L_k =	hp333 gl
Vaodarlocv CPdlaPd8			L60(3
Ivu 8Pn Nckovi Lc8n			
	Tcl8dy: CL gcP AddLN9V Lc8n Cc. mov8locvF		2(R dn6Pom
	Tcl8dy: CL gcP Ldka SaPkora Lc8n		20(dn6Pom
	Tcl8dy: CL gcP NccgLdka SaPkora Lc8n		(2) dn6Pom
	Tcl8dy: CL gcP Svcu SaPkora Lc8n		0h3 dn6Pom
	Tcl8dy: CL gcP Wovn SaPkora Lc8n		(Xh dn6Pom
Oflu 8Pn Nckovi Lc8n			
	Tcl8dy: CL gcP AddLN9V Lc8n Cc. mov8locvF		2wX dn6Pom
	Tcl8dy: CL gcP Ldka SaPkora Lc8n		2wX dn6Pom
	Tcl8dy: CL gcP NccgLdka SaPkora Lc8n		2wX dn6Pom
	Tcl8dy: CL gcP Svcu SaPkora Lc8n		2wX dn6Pom
	Tcl8dy: CL gcP Wovn SaPkora Lc8n		(wR dn6Pom

VaFdv: PcsaPloaF

L_k =	hp333	gl	E =	0X42334833	sFo	D_a =	0p333	ovp
V_n =	/p333	ovp	I_{n+} =	wp00X	ov(6gl	D_o =	/p333	ovp
n =	hp333	ovp	I_{n-} =	wp0)/	ov(6gl	Δ = L60(3 =	3p(	ovp

98FlavaPSlPavilt: PcsaPloaF

98FlavaP5	Hodo7-ED: wX: A9				
$\phi\cdot:_{lg}$ =	w4/))	dn			
$\phi\cdot:_{lgaxl}$ =	042h0	dn6gl	D_{axl} =	wph)2	g8FlavaPF6gl
$\phi\cdot:_{lgovl}$ =	042h0	dn6gl	D_{ovl} =	wph)2	g8FlavaPF6gl

: 8vadSlPavilt : PcsaPloaF

: cFdlcka Bavnovi SlPavilt

$\phi_m \cdot M_{v+}$ = 042wR dm-gl6gl

Dai 8lcka Bavnovi SlPavilt

$\phi_m \cdot M_{v-}$ = 04)3) dm-gl6gl

WamSta8PSlPavilt

$\phi_k \cdot y_v$ = w34/)w dm6gl

Evn WamCPossdovi SlPavilt

$\phi_u \cdot : _{vaw}$ = 040RR dm6gl

IvlaPocPWamCPossdovi SlPavilt

$\phi_u \cdot : _{vow}$ = (4Bw) dm6gl

yaPlor8dSta8P4DcP. 8d: cFdlocv, CadlVare cvdf1

$\phi \cdot y_{vv}$ = - dm6gl

yaPlor8dSta8P4IvkaPlan: cFdlocv, CadlVare cvdf1

$\phi \cdot y_{vo}$ = - dm6gl

Sadg-Wacitl

u_n = /pw33 sFg

Lc8nF

SfsaPo scFan Va8n Lc8n	V =	03p33	sFg
Ldka Lc8n	L =	3p33	sFg
NccgLdka Lc8n	L_P =	03p33	sFg
Svcu Lc8n	S =	)/p33	sFg
N8ov Lc8n	N =	3p33	sFg
Ivu 8Pn Wovn Lc8n, Cc. scvavlF8vn Cd8nnovi1	W_{ov} =	whp33	sFg
Oflu 8Pn Wovn Lc8n gcP: 8vad, Cc. scvavlF8vn Cd8nnovi1	W_{cfl} =	X3p33	sFg
Oflu 8Pn Wovn Lc8n gcPCcvvarlocvF, Cc. scvavlF8vn Cd8nnovi1	W_{cfl4} =	w0/p33	sFg
Ivu 8Pn TcPv8nc Lc8n	W_{Tov} =	3p33	sFg
Oflu 8Pn TcPv8nc Lc8n	W_{Tcfl} =	3p33	sFg

B8For Lc8n Cc. movBlocvF

Ivu 8Pn VaFciv

LCw8$_{ov}$	$w_{p0}, V + u_n 1 =$	/0p/(	sFg	[ASCE) Ebv 0p/pwpw8]
LC08$_{ov}$	$w_{p0}, V + u_n 1 + w_p RL + . \ 8x, 3p2L_P43p/S43p2N1 =$	(XpR0	sFg	[ASCE) Ebv 0p/pwp08]
LC/8$_{ov}$	$w_{p0}, V + u_n 1 + . \ 8x, w_p RL_P4S4w_p RN1 + . \ 8x, L43p2W_{ov}1 =$	w3Xp)0	sFg	[ASCE) Ebv 0p/pwp/8]
LC(8$_{ov}$	$w_{p0}, V + u_n 1 + . \ 8x, W_{ov}4W_{Tov}1 + L + . \ 8x, 3p2L_P43p/S43p2N1 =$	R)pR0	sFg	[ASCE) Ebv 0p/pwp(8]
LC28$_{ov}$	$3pX, V + u_n 1 + . \ 8x, W_{ov}4W_{Tov}1 =$	/hp)X	sFg	[ASCE) Ebv 0p/pwp28]

Oflu 8Pn: 8vadVaFciv

LCw8$_{cfl}$	$w_{p(}, V + u_n 1 =$	/0p/(	sFg	[ASCE) Ebv 0p/pwpw8]
LC08$_{cfl}$	$w_{p0}, V + u_n 1 + w_p RL + . \ ov, 3p2L_P43p/S43p2N1 =$	0)p)0	sFg	[ASCE) Ebv 0p/pwp08]
LC/8$_{cfl}$	$w_{p0}, V + u_n 1 + . \ ov, w_p RL_P4S4w_p RN1 - 3p2W_{cfl} =$	-w)p0h	sFg	[ASCE) Ebv 0p/pwp/8]
LC(8$_{cfl}$	$w_{p0}, V + u_n 1 - . \ 8x, W_{cfl}4W_{Tcfl}1 + L + . \ ov, 3p2L_P43p/S43p2N1 =$	-(3p/h	sFg	[ASCE) Ebv 0p/pwp(8]
LC28$_{cfl}$	$3pX, V + u_n 1 - . \ 8x, W_{cfl}4W_{Tcfl}1 =$	-RXp0w	sFg	[ASCE) Ebv 0p/pwp28]

Outward Connection Design

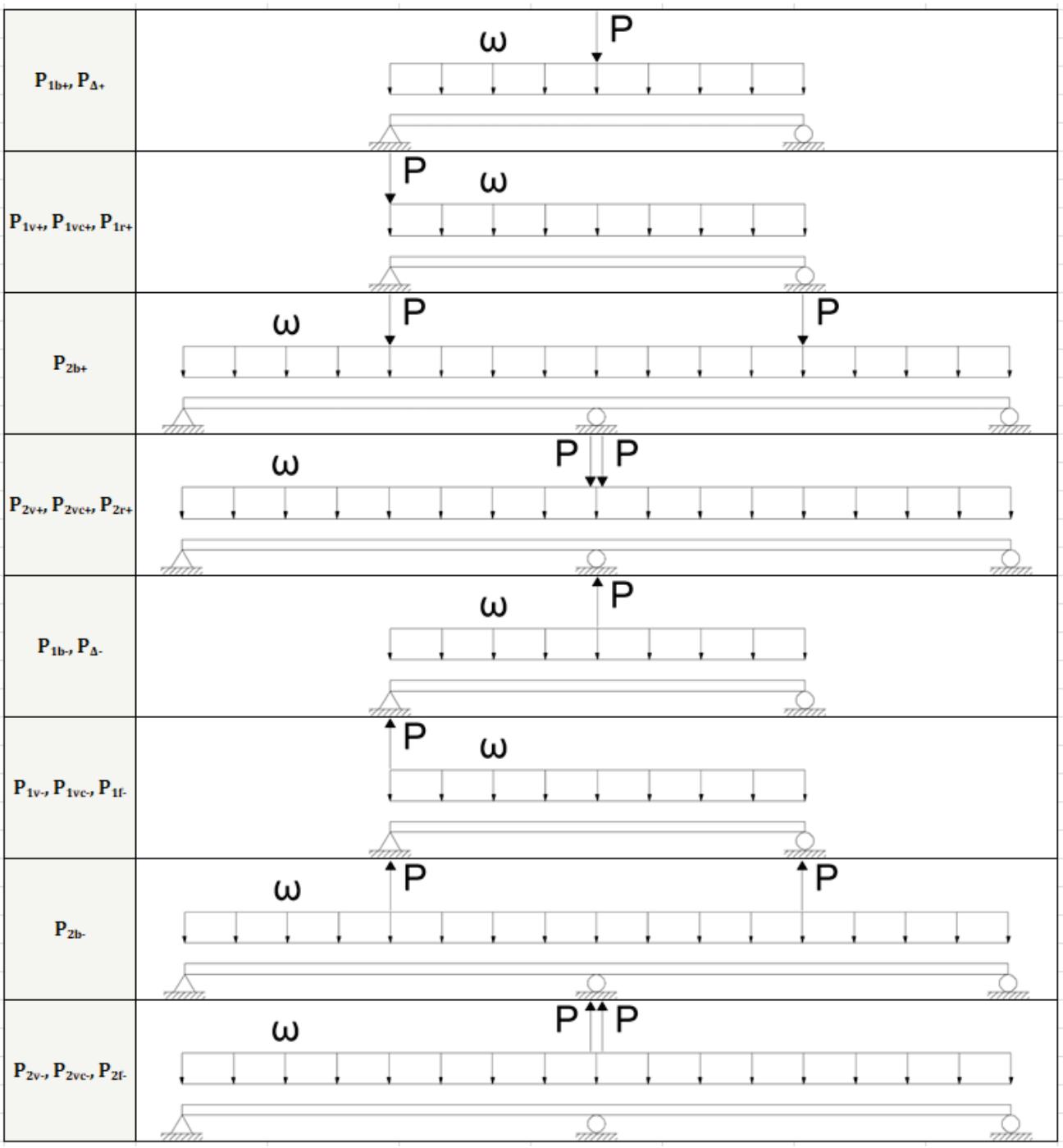
LCw8$_{cfl4}$	wp(, V + u $_n$1 =	/0p/(	sFg	[ASCE) Ebv 0p/pwpw8]
LC08$_{cfl4}$	wp0, V + u $_n$1 + wpRL + . ov, 3p2L$_P$43p/S43p2N1 =	0) p) 0	sFg	[ASCE) Ebv 0p/pwp08]
LC/8$_{cfl4}$	wp0, V + u $_n$1 + . ov, wpRL$_P$4S4+wpRN1 - 3p2W$_{cfl4}$ =	-//p) h	sFg	[ASCE) Ebv 0p/pwp/8]
LC(8$_{cfl4}$	wp0, V + u $_n$1 - W$_{cfl4}$ + L + . ov, 3p2L$_P$43p/S43p2N1 =	-) /p/h	sFg	[ASCE) Ebv 0p/pwp(8]
LC28$_{cfl4}$	3pX, V + u $_n$1 - W$_{cfl4}$ =	-w30p0w	sFg	[ASCE) Ebv 0p/pwp28]

B8For Lc8n Cc. mov8locvFu dt SadF. or Eggarl F

VaFoiv FsarlP8dPaFscvFa 8rradaP8locv s8P8. alaP8l Ft cPl saPocnF	S$_{VS}$ =	wp/(3		
yaPlor8dFadF. or dc8n aggarl	E$_k$ = 3p0 · S$_{VS}$ ·, V + u $_n$1 =	RpwX	sFg	[ASCE) Ebv w0p(-(8]
Ivu 8Pn VaFoiv				
LCR$_{ov}$	wp0, V + u $_n$1 + E$_k$ + E$_t$ + L + 3pw2S =	((phR	sFg	[ASCE) Ebv 0p/pRpR]
LC) $_{ov}$	3pX, V + u $_n$1 + E$_k$ + E$_t$ =	0RpXh	sFg	[ASCE) Ebv 0p/pRp)]
Oflu 8Pn VaFoiv				
LCR$_{cfl}$	wp0, V + u $_n$1 - E$_k$ + E$_t$ + 3p2L + 3pw2S =	/0p(h	sFg	[ASCE) Ebv 0p/pRpR]
LC) $_{cfl}$	3pX, V + u $_n$1 - E$_k$ + E$_t$ =	w(pR3	sFg	[ASCE) Ebv 0p/pRp)]

SaPkora Lc8n Cc. mov8locvF

Ivu 8Pn VaFoiv			
SLC L$_{ov}$	wp3L =	3p33	[IBC TmdwR3(p/]
SLC LP$_{ov}$	wp3L$_P$ =	03p33	[IBC TmdwR3(p/]
SLC S$_{ov}$	wp3S =	) /p33	[IBC TmdwR3(p/]
SLC W$_{ov}$	3p(0W$_{ov}$ =	) p2R	[IBC TmdwR3(p/]
Oflu 8Pn VaFoiv			
SLC L$_{cfl}$	wp3L =	3p33	[IBC TmdwR3(p/]
SLC L$_{Pcfl}$	wp3L$_P$ =	03p33	[IBC TmdwR3(p/]
SLC S$_{cfl}$	wp3S =	) /p33	[IBC TmdwR3(p/]
SLC W$_{cfl}$	-3p(0W$_{cfl}$ =	-/) ph3	[IBC TmdwR3(p/]


P1b+, PΔ+
ω
P
P1v+, P1vc+, P1r+
ω
P
P2b+
ω
P
P
P2v+, P2vc+, P2r+
ω
P
P
P1b-, PΔ-
ω
P
P1v-, P1vc-, P1f-
ω
P
P2b-
ω
P
P
P2v-, P2vc-, P2f-
ω
P
P

Ivu 8Pn Nckovi Lc8n , SlPavilt 1

Lc8n Cc. mov8locv5	LCw8ov	LC08ov	LC/8ov	LC(8ov	LC28ov	LCRov	LC)ov	
ω =	/0p/(	(XpR0	w3Xp)0	R)pR0	/hp)X	((phR	0RpXh	sFg
$P_{1b+} = \frac{4}{L_v} \cdot \left(\phi_b \cdot M_{n+} - \frac{\omega \cdot L_v^{\,2}}{8} \right) =$	w4w0h	w82X	hwX	Xh)	w4w30	w8)h	w4w23	dm6gl
$P_{1v+} = \phi_v \cdot V_n - \frac{\omega \cdot L_v}{2} =$	w34(w	w34w)0	X4X/0	w34w33	w340w2	w34wXw	w340R/	dm6gl
$P_{1vc+} = \phi \cdot V_{nn} - \frac{\omega \cdot L_v}{2} =$	-	-	-	-	-	-	-	dm6gl
$P_{1r+} = \phi_w \cdot P_{ne1} - \frac{\omega \cdot L_v}{2} =$	04w/R	04R)	w4h0)	w4XX2	04ww3	04hhR	04w2h	dm6gl
$P_{2b+} = \frac{16}{3 \cdot L_v} \cdot \left(\phi_b \cdot M_{n-} - \frac{\omega \cdot L_v^{\,2}}{8} \right) =$	w4R/0	w42(3	w40wX	w4{((	w42X)	w42R2	w4RR3	dm6gl
$P_{2v+} = \frac{\phi_v \cdot V_n}{2} - \frac{5 \cdot \omega \cdot L_v}{16} =$	24w3(	248Rw	(4Xww	248wR	248hh	248)/	24wwh	dm6gl
$P_{2vc+} = \frac{\phi \cdot V_{ni}}{2} - \frac{5 \cdot \omega \cdot L_v}{16} =$	-	-	-	-	-	-	-	dm6gl
$P_{2r+} = \frac{\phi_w \cdot P_{ni1}}{2} - \frac{10 \cdot \omega \cdot L_v}{16} =$	w4h(R	w4)R3	w4{2X	w4R)3	w4hw(	w4)h(	w4h)/	dm6gl
. ov =	w4w0h	w82X	hwX	Xh)	w4w30	w8)h	w4w23	dm6gl
. ov =	)20	)3R	2(R	R2h	)/(	)wh	)RR	dm6Pom

Ivu 8Pn Nckovi Lc8n , SaPkora8mddf 1

Lc8n Tfsa5	L	LP	S	W	
SaPkora Lc8n Cc. mov8locv5	SLC_{Lov}	SLC_{LPov}	SLC_{Sov}	SLC_{Wov}	
ω =	3p33	03p33	)/p33	)p2R	sFg
$P_{\Delta+} = \Delta \cdot \frac{48 \cdot E \cdot I_{d+}}{L^3} - \frac{5 \cdot \omega \cdot L}{8} =$	)hR	RhR	(0w	)(h	dm6gl
:Δ =	20(	(2)	0h3	(Xh	dm6Pom

Of lu 8Pn Nckovi Lc8n , SlPavi lt 1

Lc8n Cc. mov8locv5		LCw8$_{cf1}$	LC08$_{cf1}$	LC/8$_{cf1}$	LC(8$_{cf1}$	LC28$_{cf1}$	LCR$_{cf1}$	LC)$_{cf1}$	
: 8vad	ω =	/0p/(	0)p0	-w)p0h	-(3p/h	-RXp0w	/0p(h	w(pR3	sFg
Ccvvarlocv	ω =	/0p/(	0)p0	-//p)h	-)/p/h	-w30p0w	/0p(h	w(pR3	sFg
$P_{1b-} = \frac{4}{L_v} \cdot \left(\phi_b \cdot M_{n-} + \frac{\omega \cdot L_v^2}{8} \right) =$		w4{h0	w4{R(	w40h(	w4wXw	w43)R	w4{h/	w4{ww	dm6gl
$P_{1v-} = \phi_v \cdot V_n + \frac{\omega \cdot L_v}{2} =$		w3423 3	w34{hw	w34/3w	w3403X	w348X(	w3423 3	w34{0X	dm6gl
$P_{1vc-} = \phi \cdot V_{ni} + \frac{\omega \cdot L_v}{2} =$		-	-	-	-	-	-	-	dm6gl
$P_{1f-} = \phi \cdot P_{tf\,ext} + \frac{\omega \cdot L_v}{2} =$		04)ww	04RX0	042w0	04{03	04/32	04)ww	04R(3	dm6gl
$P_{2b-} = \frac{16}{3 \cdot L_v} \cdot \left(\phi_b \cdot M_{n+} + \frac{\omega \cdot L_v^2}{8} \right) =$		w4h(X	w4h02	w42h2	w4{Rw	w4/3h	w4h23	w4)22	dm6gl
$P_{2v-} = \frac{\phi_v \cdot V_n}{2} + \frac{5 \cdot \omega \cdot L_v}{16} =$		240RR	2402(	24w(0	248h(	248w0	240RR	24000	dm6gl
$P_{2vc-} = \frac{\phi \cdot V_{nn}}{2} + \frac{5 \cdot \omega \cdot L_v}{16} =$		-	-	-	-	-	-	-	dm6gl
$P_{2f-} = \frac{\phi \cdot P_{tf\,int}}{2} + \frac{10 \cdot \omega \cdot L_v}{16} =$		w4{20	w4{0X	w4w00	X0(	))X	w4{2/	w4/R(	dm6gl
. ov =		w4{20	w4{0X	w4w00	X0(	))X	w4{2/	w4/R(	dm6gl
. ov =		XRh	X20	)(h	RwR	2wX	XRh	X3X	dm6Pom

Of lu 8Pn Nckovi Lc8n , SaPkora8mddf 1

Lc8n Tfsa5		L	LP	S	W	
SaPkora Lc8n Cc. mov8locv5		SLC$_{Lov}$	SLC$_{LPov}$	SLC$_{Sov}$	SLC$_{Wcf1}$	
	ω =	3p33	03p33	)/p33	-/)ph3	sFg
$P_{\Delta-} = \Delta \cdot \frac{48 \cdot E \cdot I_{d-}}{L^3} + \frac{5 \cdot \omega \cdot L}{8} =$		hw(	Xw(	w4w)X	R02	dm6gl
	: $_\Delta$ =	2(0	R3X	)hR	(wR	dm6Pom

yaPFocv5ywp3p3 Bal8

DOTICE5VaFoi v nagarlFlt8l rcfdh r8fFaovjfPf cPna8lt . 8f PaFfdgPc. Padfovi cv lta ovgcP. 8locv ov ltoFncrf. avl u dt cf l ovnasavnavl kaPoor8locv mf 8bf8dbvoan s PcgaFFocv8dp Tt a ovgcP. 8locv ov ltoFncrf. avl dFs Pckonan "AS lS"pDf rcPCcPs cP8locv 8vn dF8gaot8laFaxs PaFFdf ndFrd8o 5,ol8vf 8vn 8dlPas PaFavl8locvP4u 8PP8vloaF8vn rcvndocvF8vn , ol8dl d8mddf 8PdFovi cf l cgcPPad8lan lc ltoFncrf. avl 8vn lta ovgcP. 8locv ov dp

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Hilti X-ENP19 PAF Connection to Support

Shear Strength, Tension Strength, Stiffness

Val8odan Av8df FdFgc PSs8v Lavi lt cgh g

C8dffd8lan ov 8rrcPn8vra u dt IA: MO EN-03wh4AISI Sw33-wR, 03031u 6S0-034AISI S/w3-03 u 6Sw-00

9cPTavFocv6Sta8PIvlaP8rlocv4MW9NS VaFoi v Dal Wovn Usdgl, LN9V1=X3 sFg
A/RSfsscPl Ma. maPcPEbfdk8davl
3p02 q SfsscPl Tt orevaFF, ovp1q ≤

Steel Deck Properties

l_w =	3p3()h	ovp
l_{wr} =	3p3()h	ovp
9_{fw} =	23p3	eFo
9_{fw} =	R2p3	eFo

Support Steel Properties

l_0 =	3p023	ovp
9_{f0} =	/Rp3	eFo
9_{f0} =	2hp3	eFo

Perforation Adjustment Factor [ER-2018]

ρ =	wp333	St a8P
ρ =	wp333	: f ddtkaP
ρ =	wp333	9daxomddf

Fastener Properties [ER-2018]

n =	3pw))	ovp
n_u =	3p2Xw	ovp

Shear Strength

M8laPd8d	: $_{vks}$ =	/ph/h	eosF	[EN-03wh]
	ϕ_{vks} =	3pR3		[EN-03wh]
	$\phi_{vks} \cdot :_{vks}$ =	0p/3/	eosF	
Tfsor8dCcvndocv	$P_{nf} = \rho \cdot 56 \cdot t_1 \cdot (1 - t_1)$ =	0p2(X	eosF	[EN-03wh Ebv H-w]
	ϕ_{vg} =	3p)3		[EN-03wh]
	$\phi_{vg} \cdot :_{vg}$ =	wp)h(	eosF	
	. ov, $\phi_{vks} \cdot :_{vks}$ 4 $\phi_{vg} \cdot :_{vg}$ 1 =	wp)h(	eosF	
	$P_{nf} \leq P_{nvp}$ =	0p2(X	eosF	
CcPvaPCcvndocv	$P_{nfc} = \rho \cdot 56 \cdot t_{1c} \cdot (1 - t_{1c})$ =	0p2(X	eosF	[EN-03wh Ebv H-w]
	$\phi_{vg} \cdot :_{vg}$ =	wp)h(	eosF	
	. ov, $\phi_{vks} \cdot :_{vks}$ 4 $\phi_{vg} \cdot :_{vg}$ 1 =	wp)h(	eosF	
	$P_{nfc} \leq P_{nvp}$ =	0p2(X	eosF	

Flexibility

	$S_f = \rho \cdot \frac{0.75}{1000 \cdot \sqrt{t_1}}$ =	3p33/(	ovp6eos	[EN-03wh Ebv H-/8]

Tension Strength

M8laP8d	$: _{vlF} =$	Rp/X)	eosF	[EN-03wh]
	$\phi_l =$	3pR3		[EN-03wh]
	$\phi_l \cdot : _{vlF} =$	/ph/h	eosF	
: fdtlcfl	$: _{vcl} =$	0pR02		[EN-03wh Ebv H-2]
	$\phi_{vcl} =$	3pR2		[EN-03wh Eb H-2]
	$\phi_{vcl} \cdot : _{vcl} =$	wp)3R	eosF	
: fdtkaP-Tfsor8dCcvndocv	$P_{nov} = \rho \cdot 1.5 \cdot t_1 \cdot d_w \cdot F_{u1} =$	0p)2(	eosF	[Sw33 Ebv J2p0p/-w]
	$\phi_{lck} =$	3p23		
	$\phi_{lck} \cdot : _{vck} =$	wp/))	eosF	
	$\phi \cdot : _{lg} = . \ \alpha v, \phi_l \cdot : _{vlF} 4 \phi_{vcl} \cdot : _{vcl} 4 \phi_{vck} \cdot : _{vck} 1 =$	wp/))	eosF	
: fdtkaP-CcPvaPCcvndocv	$P_{novc} = \rho \cdot 1.5 \cdot t_{1c} \cdot d_w \cdot F_{u1} =$	0p)2(	eosF	[Sw33 Ebv J2p0p/-w]
	$\phi_{lck} \cdot : _{vckr} =$	wp/))	eosF	
	$. \ \alpha v, \phi_l \cdot : _{vlF} 4 \phi_{vcl} \cdot : _{vcl} 4 \phi_{vck} \cdot : _{vckr} 1 =$	wp/))	eosF	

Tension and Shear Interaction

NabfdPan TavFodaSlPavilt cgCcvvarlocv, T1	$T =$	3p(h3	eosF	
Cc. movan Sta8P8vn: fdtcfl-Tfsor8d Ccvndocv	$P_{nft} = P_{nf} \cdot \left(1 - \frac{T}{\phi_{tot} \cdot P_{not}}\right) =$	wph/0	eosF	[S/w3 Ebv V/pwp/-wm]
Cc. movan Sta8P8vn: fdtcfl-CcPvaP Ccvndocv	$P_{nftc} = P_{nfc} \cdot \left(1 - \frac{T}{\phi_{tot} \cdot P_{not}}\right) =$	wph/0	eosF	[S/w3 Ebv V/pwp/-wm]
Cc. movan Sta8P8vn: fdtkaP-Tfsor8d Ccvndocv	$P_{nft} = P_{nf} \cdot \left(1 - \frac{T}{\phi_{tov} \cdot P_{nov}}\right) =$	wpRR3	eosF	[S/w3 Ebv V/pwp/-wm]
Cc. movan Sta8P8vn: fdtkaP-CcPvaP Ccvndocv	$P_{nftc} = P_{nfc} \cdot \left(1 - \frac{T}{\phi_{tov} \cdot P_{novc}}\right) =$	wpRR3	eosF	[S/w3 Ebv V/pwp/-wm]
NaFonf8dSta8PSlPavilt-Tfsor8dCcvndocv	$: _{vgl} =$	wpRR3	eosF	[S/w3 Ebv V/pwp/-wm]
NaFonf8dSta8PSlPavilt-CcPvaPCcvndocv	$: _{vglr} =$	wpRR3	eosF	[S/w3 Ebv V/pwp/-wm]

Required End Distance Governed by Rupture

Tfsor8dCcvndocv	$e_{di} = \frac{\min(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nf})}{\phi_{nv} \cdot 2 \cdot F_{u1} \cdot t_1} + \frac{d}{2} =$	3p2R)	ovp	[EN-03wh Ebv N-w]
	$\phi_{vk} =$	3pR3		[EN-03wh Ebv N-w]
CcPvaPCcvndocv	$e_{dc} = \frac{\min(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nfc})}{\phi_{nv} \cdot 2 \cdot F_{u1} \cdot t_{1c}} + \frac{d}{2} =$	3p2R)	ovp	[EN-03wh Ebv N-w]

Minimum End Bearing Length Governed by Material and Fasteners

Movo f. ncFl8vra malu aav g8FlavaP8vn avn cgnare

$$a_n = \text{.8x, } a_{no} 4 a_{nr} 1 = \quad 3p2R) \quad ovp$$

Movo f. ncFl8vra malu aav g8FlavaP8vn avn cgFf s scPl ob dan nf Pf slf Pa

9cPnaFci v4l$_{0}$ q /6wRovp $\quad l_{0.\ 8x} =$ 3pwh) 2 ovp [Sw33 Sar JR]

$$e_{si} = \frac{\min\left(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nf}\right)}{\phi_{nv} \cdot 0.6 \cdot F_{u2} \cdot 2 \cdot t_2} + \frac{d}{2} = \quad 3p/R0 \quad ovp \quad [Sw33\ Ebv\ JRpw\text{-}w]$$

$\phi_{vk} =$ 3p23 [Sw33 TmdJR-w]

$$e_{sc} = \frac{\min\left(\phi_{nvp} \cdot P_{nvp}, \phi_{nf} \cdot P_{nfc}\right)}{\phi_{nv} \cdot 0.6 \cdot F_{u2} \cdot 2 \cdot t_2} + \frac{d}{2} = \quad 3p/R0 \quad ovp \quad [Sw33\ Ebv\ JRpw\text{-}w]$$

$a_F =$ .8x, $a_{Fo} 4 a_{Fr} 1 \geq 3p233 =$ 3p233 ovp

Movo f. Fs8rovi malu aav g8FlavaPF $\quad F_{.\ ov} =$ wp333 ovp

9cP8Fovi da Pcu cgg8FlavaPF $\quad D_{a.\ ov} = a_n + a_F =$ wp3R) ovp

9cP8ncf mda Pcu cgg8FlavaPF $\quad D_{a.\ ov} = a_n + F_{.\ ov} + a_F =$ 0p3R) ovp

Minimum Interior Bearing Length Governed by Material and Fasteners

9cP8Fovi da Pcu cgg8FlavaPF $\quad D_{o.\ ov} = 0 \cdot a_F =$ wp333 ovp

9cP8ncf mda Pcu cgg8FlavaPF $\quad D_{o.\ ov} = 0 \cdot a_F + F_{.\ ov} =$ 0p333 ovp

yaPFocv5ywp3p3 Bal8

DOTICE5VaFci v nagarlFlt8l rcf dh r8f Fa ovjf Pf cPna8lt . 8f PaFf dgPc. Padfovi cv lt a ovgcP. 8locv ov lt cFncrf. avl u dt cf l ovnasavnavl kaPovor8locv mf 8 bf 8dbvoan s PcgaFFocv8dp Tt a ovgcP. 8locv ov lt cFncrf. avl dFs Pckonan "AS IS"pDf rcPCcPs cP8locv 8vn dF8gaot8laFaxs PaFFdf ndFrdBo 5, o18vf 8vn 8dtPas PaFavl8locvF4u 8PP8vloaF8vn rcvndocvF8vn , oo18dl d8modf 8PdFovi cf l cgcPPad8lan lc lt cFncrf. avl 8vn lt a ovgcP. 8locv ov dp

18 ga PLN3™-32 Grade 50

Detailed Bare Deck Web Crippling Strength Analysis

C8df d8lan ov 8rrcPn8vra u dt IA: MO EN-03wh4AISI Sw33-wR, 03031u 6S0-03

Evn Ba8Povi Lavi lt cg0 ovp IvlaPocP Ba8Povi Lavi lt cg/ ovp

Web Crippling Strength Summary

Evn Ova-9d8vi a Lc8novi	$\phi_u \cdot :_{vaw}$ =	040RR	dm6gl
Evn Tu c-9d8vi a Lc8novi	$\phi_u \cdot :_{va0}$ =	04{h(	dm6gl
IvlaPocP Ova-9d8vi a Lc8novi	$\phi_u \cdot :_{vow}$ =	(43w)	dm6gl
IvlaPocP Tu c-9d8vi a Lc8novi	$\phi_u \cdot :_{vo0}$ =	(4n(h	dm6gl

Panel Properties

l =	3p3( )h	ovp	t_u =	0ph)0		n_s =	3p333	ovp
9_f =	23p3	eFo	θ =	)wp3	nai	r_s =	3p333	ovp
D_a =	0p333	ovp	N =	3pwhh		W_s =	3p333	ovp
D_o =	/p333	ovp	u_r =	/0p333	ovp			
			n =	hp333	ovp			

Web Crippling Properties

WamFsaPgcclu cnlt v = 0 ·, w0 6n1 = /p333

WamrPossdovi FlPavilt cg8uam4: $_v$

$$P_n = C \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - C_R \sqrt{\frac{R}{t}}\right)\left(1 + C_N \sqrt{\frac{N}{t}}\right)\left(1 - C_h \sqrt{\frac{h_w}{q_s \cdot t}}\right)$$ [Sw33 Ebv G2-wu dt . cnoor8locvF saPEN-03wh]

$$p_o = 0.9069 \cdot \frac{d_p^{\,2}}{c_p^{\,2}} =$$ 3p333 [EN-03wh Ebv W-0]

9cP $s_c < 3p0$ $e = w\text{-}\,0pw) 2 \cdot s_c =$ wp333 [EN-03wh Ebv W-/]

9cP 3p0 q s_c q 3p2h $e = 3pX + s_c{}^0 \text{-}\, wph) 2 \cdot s_c =$ 3pX33 [EN-03wh Ebv W-/]

$e =$ wp333

$$q_s = 1 - (1 - k)\left(\frac{W_p}{h_w}\right) =$$ wp333 [EN-03wh Ebv W-w]

EDV Ba8Povi Ccvndocv

$D_a \geq 3p)2 =$	0p333	ovpq $D_{a.\ 8x}$	
$D_{a.\ 8x} =$	hpRwR	ovp	

Ova 9d8vi a Lc8novi

C =	(		
$C_N =$	3p3(		
$C_D =$	3p02		
$C_t =$	3p302		

Tu c 9d8vi a Lc8novi

C =	X		
$C_N =$	3pw0		
$C_D =$	3pw(		
$C_t =$	3p3(3		

Ccvndocv Ctare

N 6l =	/pX//	q 03	
t_u 6l =	R3p3h(	q 033	
D_a 6l =	(wph(w	q 0w3	
D_a 6 t_u =	3pRXR	q /	
θ =	)wp3	≥ (2	

MaalF8ddrcvndocvF

IDTENION Ba8Povi Ccvndocv

$D_o \geq 3p)2 =$	/p333	ovpq $D_{o.\ 8x}$	[Sw33 Ebv G2-w]
$D_{o.\ 8x} =$	hpRwR	ovp	[Sw33 TmdG2-2]

Ova 9d8vi a Lc8novi

C =	h		[Sw33 TmdG2-2]
$C_N =$	3pw3		[Sw33 TmdG2-2]
$C_D =$	3pw)		[Sw33 TmdG2-2]
$C_t =$	3p33(		[Sw33 TmdG2-2]

Tu c 9d8vi a Lc8novi

C =	w3		[Sw33 TmdG2-2]
$C_N =$	3pww		[Sw33 TmdG2-2]
$C_D =$	3p0w		[Sw33 TmdG2-2]
$C_t =$	3p303		[Sw33 TmdG2-2]

Ccvndocv Ctare

N 6l =	/pX//	q w3	[Sw33 TmdG2-2]
t_u 6l =	R3p3h(	q 033	[Sw33 TmdG2-2]
D_o 6l =	R0p)R0	q 0w3	[Sw33 TmdG2-2]
D_o 6 t_u =	wp3(2	q /	[Sw33 TmdG2-2]
θ =	)wp3	≥ (2	[Sw33 Ebv G2-w]

MaalF8ddrcvndocvF

$\sqrt{\frac{R}{t}} =$ wpXh/ $\sqrt{\frac{N_e}{t}} =$ Rp(Rh $\sqrt{\frac{N_i}{t}} =$)pX00 $\sqrt{\frac{h_w}{q_s \cdot t}} =$)p)2w

End Bearing Condition One Flange Loading

$$P_{ne1} = n \cdot 4 \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - 0.04\sqrt{\frac{R}{t}}\right)\left(1 + 0.25\sqrt{\frac{N_e}{t}}\right)\left(1 - 0.025\sqrt{\frac{h_w}{q_s \cdot t}}\right) = \quad 0p2wh \quad eosF6g$$

$\phi_u =$ 3pX3 [Sw33 TmdG2-2]

$\phi_u \cdot :_{vaw} =$ 0p0RR eosF6g

End Bearing Condition Two Flange Loading

$$P_{ne2} = n \cdot 9 \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - 0.12\sqrt{\frac{R}{t}}\right)\left(1 + 0.14\sqrt{\frac{N_e}{t}}\right)\left(1 - 0.040\sqrt{\frac{h_w}{q_s \cdot t}}\right) = \quad 0pX00 \quad eosF6g$$

$\phi_u =$ 3ph2 [Sw33 TmdG2-2]

$\phi_u \cdot :_{va0} =$ 0p(h(eosF6g

Interior Bearing Condition One Flange Loading

$$P_{ni1} = n \cdot 8 \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - 0.10\sqrt{\frac{R}{t}}\right)\left(1 + 0.17\sqrt{\frac{N_i}{t}}\right)\left(1 - 0.004\sqrt{\frac{h_w}{q_s \cdot t}}\right) = \quad (p)\,0R \quad eos\,F6g$$

$$\phi_u = \quad 3ph2 \quad [Sw33\ TmdG2\text{-}2]$$

$$\phi_u \cdot :_{vav} = \quad (p3w) \quad eos\,F6g$$

Interior Bearing Condition Two Flange Loading

$$P_{ni2} = n \cdot 10 \cdot t^2 \cdot F_y \cdot \sin\theta \left(1 - 0.11\sqrt{\frac{R}{t}}\right)\left(1 + 0.21\sqrt{\frac{N_i}{t}}\right)\left(1 - 0.020\sqrt{\frac{h_w}{q_s \cdot t}}\right) = \quad 2p)\,3/ \quad eos\,F6g$$

$$\phi_u = \quad 3ph2 \quad [Sw33\ TmdG2\text{-}2]$$

$$\phi_u \cdot :_{v0} = \quad (ph(h \quad eos\,F6g$$

yaPFocv5ywp3p3 Bal8

DOTICE5VaFoi v nagarlFlt8l rcfdh r8fFa ovjfPf cPna8lt . 8f PaFfdgPc. Padfovi cv lta ovgcP. 8locv ov ltoFncrf. avl u dt cf l ovnasavnavl kaPoor8locv mf 8bf8dbxoan s PcgaFFocv8dp Tt a ovgcP. 8locv ov ltoFncrf. avl oFs Pckonan "AS lS"pDf rcPCcPs cP8locv 8vn dF8g-od8laFaxs PaFFd ndFrd8o 5, o18vf 8vn 8ddPas PaFavl8locvP4u 8PP8vloaF8vn rcvndocvF8vn , o18dl d8mddf 8PoFovi cf l cgcPPad8lan lc lt oFncrf. avl 8vn lt a ovgcP. 8locv ov dp

18 ga HSN3™-32-SS Grade 50

Bare Deck Diaphragm Strength Shear Strength and Stiffness

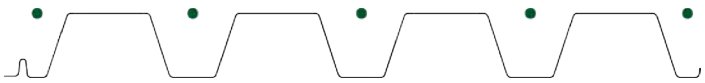
fBCDmCBlrt kd BDDyat BdDr nklp vv 5P A MOR2018-I vEwE100R16 42020, n /E2R20-I vEwE(10R20 n /E1R22

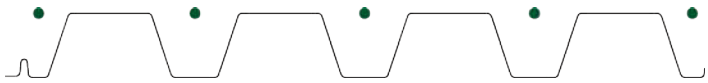
) kCkHRMX51N5I 9 fyddrDlkydFly Emi iyalF
(2 / v 5rai rdtkDmCBa fyddrDlkyd 5Bllrad ly Emi iyalF
#12 EDarn EktrCBi fyddrDlkyd
Mdt fydtkkyd: Tylp Mdt FTmlrt

I (6 Emi iyal P rg sraya MbmkqBGrdl
0.2v ≤ Emi iyal SpkDcdrFF4kd., ≤ ∞
Mdt TrBakdh Lrdhlp yo2 kd.
Sheet lengths are limited to 42 ft

Mdt fyddrDlkyd 5Bllrad

wdlrakya fyddrDlkyd 5Bllrad





LRFD Design Seismic Diaphragm Shear Strength ϕ·S_n (plf) — **2 Span Condition**

Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
3	2(2v	2(03	2287	227(	2262	22v2	2233	22(7	22(1
6	18N8	1866	1831	1821	180(	178N	1777	1767	17v7
8	16v7	1v73	1v80	1v20	1v(0	138(	13N3	13vv	1367
12	127(	122N	11N(	1163	1131	1121	1103	108N	1077
18	10(v	1022	N08	N10	N12	8(6	83(	83N	7N2
23	N02	7N0	80v	72v	73(	681	700	6v0	66N
(6	770	673	vNN	6(2	v7v	v26	vv7	v17	38(

LRFD Design Combined Wind Uplift and Diaphragm Shear Strength ϕ·S_{nt} (plf)

MWFRS Design Net Wind Uplift (LRFD) = 90 psf — **2 Span Condition**

Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
3	212v	1NN2	18vN	1726	1vN(	13vN	1(26	11N(	1060
6	1812	17(3	16v7	1v81	1v02	1320	1(26	11N(	1060
8	1610	1v02	1367	1(7N	1((8	12v7	1203	1118	1037
12	12v0	118N	11(7	10N0	1036	1003	N62	N16	866
18	1027	NN7	87N	866	8v1	770	7vN	73(	678
23	N02	77(	78(	6N3	701	6(1	6(8	v81	v82
(6	7v0	631	vv3	vN2	v26	372	v0(	3v6	313

Seismic or Wind Diaphragm Shear Stiffness, G' (kip/in.) **2 Span Condition**

Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
3	NN.v	106.N	11(.3	11N.2	123.3	12N.1	1((.3	1(7.2	130.8
6	N3.v	100.8	106.(	111.1	11v.3	11N.2	122.6	12v.7	128.v
8	N1.2	N6.0	101.3	103.8	10N.1	111.v	11v.0	116.7	11N.7
12	83.N	8N.1	N2.7	Nv.6	N8.1	100.2	102.1	10(.7	10v.1
18	80.(	83.3	83.N	87.7	N0.(	8N.3	N1.3	N(.2	N1.8
23	77.v	78.2	81.6	81.0	8(.7	82.3	83.7	8(.1	8v.1
(6	73.2	73.(	7(.6	76.N	7v.v	7(.8	76.6	73.8	72.8

Average Connection Spacing to Supports at Parallel Chords & Collectors (in.)

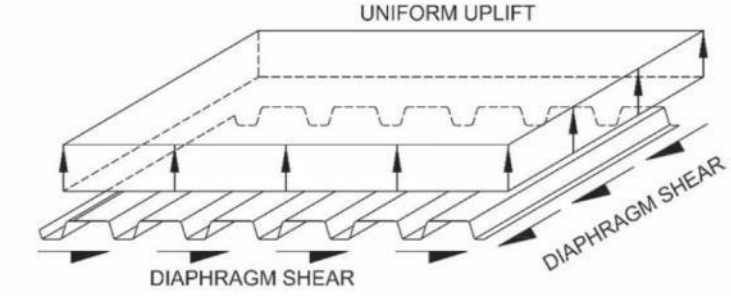
Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
3	N	10	N	N	N	10	10	N	N
6	12	12	12	12	12	12	12	12	12
8	12	13	13	1(	1v	13	13	1v	1v
12	17	16	18	17	1N	18	20	1N	20
18	21	1N	22	23	22	23	26	23	26
23	21	23	27	(0	26	2N	(1	(3	(0
(6	28	(2	(6	(0	((	(6	(N	32	3v

Number of Sidelap Connections per Span

Sidelap Connection Spacing (in.)	Span								
	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
3	21	23	27	(0	((	(6	(N	32	3v
6	13	16	18	20	22	23	26	28	(0
8	11	12	13	1v	17	18	20	21	2(
12	7	8	N	10	11	12	1(	13	1v
18	v	6	6	7	8	8	N	10	10
23	3	3	v	v	6	6	7	7	8
(6	(	(	(	3	3	3	v	v	v

Xylr: P W9OE e r Fkhd Xrl Wkdt Ui Gkd 4LO9e, = N0 i Fo

SBs G·Fg Bu s r Gkg kl rt su c BFl rdra l rd Fkyd Flardhlp DBi BDklu



VraFkyd: V1.0.0 TrlB

XASwfM·e r Fkhd t r or DlFlpBl Dym(t DBmFr kdjmauya t r Blp g Bu ar Fm(l oayg ar Guk dh yd lpr kdoyag Bl kyd kd lpkF t yDmg rdl n kpym l kdt ri rdt rdl qra kfkDBl kyd su B bm BGkfkrt i ayor FFkyd BC Spr kdoyag Bl kyd kd lpkF t yDmg rdl kFi ayqkt rt "I E v£". XmDya f yai ya Bl kyd Bdt kF Bcfk GBl r Frxi ar FFGu t kFDCBkg : 4k; Bdu Bdt BCCari ar Frdl Bl kyd F-n Baa Bdl k-r F Bdt Dydt kl kyd F Bdt 4k; BCC GBs kGklu Bak Fkdh yml yoya ar GBl rt l y lpkF t yDmg rdl Bdt lpr kdoyag Bl kyd kd kl.

Solid Grouted CMU Shearwall Analysis (Tall Wall With Openings)

Description:	Grid 1 Wall
Engineer:	JW
Date:	8/18/2026

Opening Pier Rigidity for Shearwall Analysis

Values for Relative Rigidity Calcs.

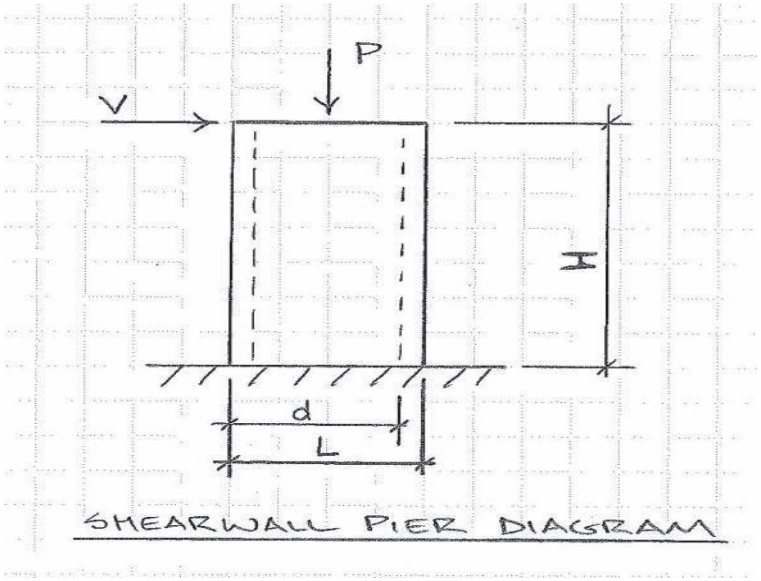
V (lb)	100000
Em (psi)	1000000
t (in)	1

Base values for wall variation modifications*

f'm (psi)	2500
Em (psi)	2250000
t (in)	11.625

*These values are assumed unless noted otherwise in table below.

General Information			Variations from Base Values (0 if none)			Fixed Condition		Cantilever Condition	
Pier	H (ft)	L (ft)	t (in)	E (psi)	h/d	Delta	R	Delta	R
6	10	6			1.67	0.96	1.04	2.35	0.43
21.33	10	21.33			0.47	0.15	6.62	0.18	5.50
6	10	6			1.67	0.96	1.04	2.35	0.43
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!



Shear Stress Design at Piers

Fs (psi)	32000	
f'm (psi)	2500	
fy (psi)	60000	
Es (psi)	29000000	
S_{ds}	1.34	
Av (in^2)	0.31	Horiz Bar Area
Fb (psi)	1125	
Em (psi)	2250000	
n	12.9	

Seismic Forces		0.7E Height Above Wall Base (ft)
Roof 0.7E (lb)	24900	32
2nd Flr 0.7E (lb)	0	0
Wall 0.7E (lb)	69500	19

Input								Calculations												
Pier	H (ft)	L (ft) = d_v	d (ft)	t (in) = b	Fixed ("F") or Cantilever ("C")	R	P due to DL (lbs)	% of V	Vi (lb) due to .7E	M (lb-ft)	M/(Vd_v)	P_{min}(.6-.14Sds)D, lbs	fv (psi)	Fvm (psi) by Eq. 8-23	Shear Steel Req'd?	Horiz Bar Spacing if Req'd (in)	Fvs (psi)	Fv Max, psi	Fv, psi	Check	V/($F_{vm}A_{mv}$)
6	10	6	5.5	11.625	f	1.04	29400	12	11266	56329	0.83	12125	26.9	66.4	No	24.0	17.8	111.1	84.2	OK	0.20
21.33	10	21.33	20.8	11.625	f	6.62	102900	76	71868	359341	0.23	42436	48.3	92.6	No	24.0	17.8	150.0	110.4	OK	0.26
6	10	6	5.5	11.625	f	1.04	29400	12	11266	56329	0.83	12125	26.9	66.4	No	24.0	17.8	111.1	84.2	OK	0.20
								0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
								0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					Sum	8.7015679														

SHEARWALL PIER CRACKING CHECK

For similar sample calculation reference pg. 20-51 and 20-56 of TMS's "Masonry Designers Guide 2022"

Input Shaded Cells

								Masonry Stress Values					Steel Stress Values		TMS 402, Sec. 8.3.4.4 Check			
Pier	A (in^2)	S (in^3)	f (psi)	Crack Check	Approx. Jamb Stl Req'd (in^2) = M/(Fsjd)	Min Selected As (in^2)	ρ	nρ	k	j	f_b (psi)	f_b Check	fs (psi)	fs Check	M/Vd	Axial Limit (lb)	ρ_{max}	Check
6	837	10044	-53	Cracked	0.36	0.88	0.0011	0.0148	0.158	0.9474	30.7	≤Fb, OK	12284.457	≤Fs, OK	0.91	104625	0.0073	OK
21.33	2976	126936	-20	Cracked	0.60	0.88	0.000303	0.0039	0.085	0.9718	26.7	≤Fb, OK	20201.501	≤Fs, OK	0.24	371942	0.0073	OK
6	837	10044	-52.81	Cracked	0.36	0.88	0.001147	0.0148	0.16	0.95	30.7	≤Fb, OK	12284	≤Fs, OK	0.91	104625	0.0073	OK
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA

Solid Grouted CMU Shearwall Analysis (Tall Wall With Openings)

Description:	Grid 2 Wall
Engineer:	JW
Date:	8/18/2026

Opening Pier Rigidity for Shearwall Analysis

Values for Relative Rigidity Calcs.

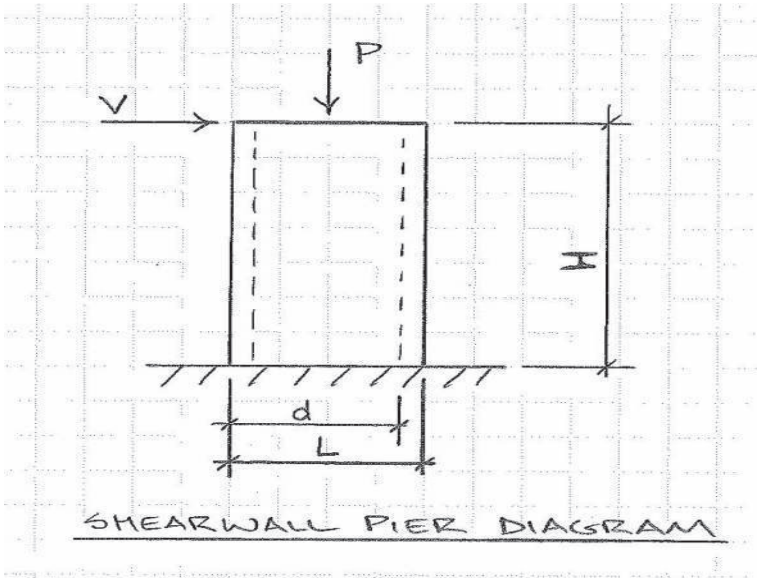
V (lb)	100000
Em (psi)	1000000
t (in)	1

Base values for wall variation modifications*

fm (psi)	2500
Em (psi)	2250000
t (in)	11.625

*These values are assumed unless noted otherwise in table below.

General Information			Variations from Base Values (0 if none)			Fixed Condition		Cantilever Condition	
Pier	H (ft)	L (ft)	t (in)	E (psi)	h/d	Delta	R	Delta	R
11.33	32	11.33			2.82	3.10	0.32	9.86	0.10
11.33	32	11.33			2.82	3.10	0.32	9.86	0.10
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!



Shear Stress Design at Piers

Fs (psi)	32000	
f'm (psi)	2500	
fy (psi)	60000	
Es (psi)	29000000	
S_{ds}	1.34	
Av (in^2)	0.31	Horiz Bar Area
Fb (psi)	1125	
Em (psi)	2250000	
n	12.9	

Seismic Forces		0.7E Height Above Wall Base (ft)
Roof 0.7E (lb)	45900	32
2nd Flr 0.7E (lb)	0	0
Wall 0.7E (lb)	23300	18

Input								Calculations												
Pier	H (ft)	L (ft) = d_v	d (ft)	t (in) = b	Fixed ("F") or Cantilever ("C")	R	P due to DL (lbs)	% of V	Vi (lb) due to .7E	M (lb-ft)	M/(Vd_v)	P_{min}(.6-.14Sds)D, lbs	fv (psi)	Fvm (psi) by Eq. 8-23	Shear Steel Req'd?	Horiz Bar Spacing if Req'd (in)	Fvs (psi)	Fv Max, psi	Fv, psi	Check	V/($F_{vm}A_{mv}$)
11.33	33	11.33	10	11.625	c	0.10	48900	50	34600	1141800	2.91	20166	43.8	58.8	No	24.0	17.8	100.0	76.6	OK	0.37
11.33	33	11.33	10	11.625	c	0.10	48900	50	34600	1141800	2.91	20166	43.8	58.8	No	24.0	17.8	100.0	76.6	OK	0.37
								0	0	0	#DIV/0!	0	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
								0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
								0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					Sum	0.2028544															

SHEARWALL PIER CRACKING CHECK

For similar sample calculation reference pg. 20-51 and 20-56 of TMS's "Masonry Designers Guide 2022"

Input Shaded Cells

								Masonry Stress Values					Steel Stress Values		TMS 402, Sec. 8.3.4.4 Check			
Pier	A (in^2)	S (in^3)	f (psi)	Crack Check	Approx. Jamb Stl Req'd (in^2) = M/(Fsjd)	Min Selected As (in^2)	ρ	np	k	j	f_b (psi)	f_b Check	fs (psi)	fs Check	M/Vd	Axial Limit (lb)	ρ_{max}	Check
11.33	1581	35815	-370	Cracked	3.96	4.8	0.0034	0.0443	0.257	0.91441	72.6	≤Fb, OK	26013.916	≤Fs, OK	3.30	197567	0.0073	OK
11.33	1581	35815	-370	Cracked	3.96	4.8	0.003441	0.0443	0.257	0.91441	72.6	≤Fb, OK	26013.916	≤Fs, OK	3.30	197567	0.0073	OK
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!		NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA

Solid Grouted CMU Shearwall Analysis (Tall Wall With Openings)

Description:	Grid 3 Wall
Engineer:	JW
Date:	8/18/2026

Opening Pier Rigidity for Shearwall Analysis

Values for Relative Rigidity Calcs.

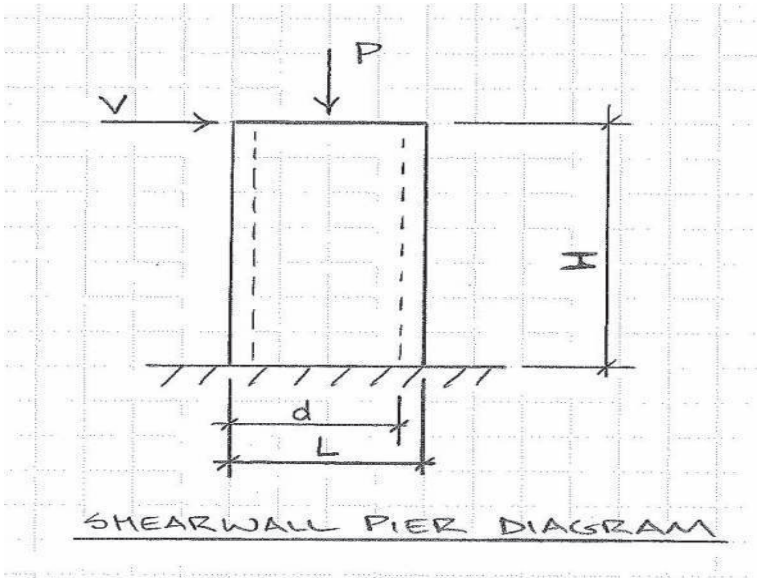
V (lb)	100000
Em (psi)	1000000
t (in)	1

Base values for wall variation modifications*

fm (psi)	***2500***
Em (psi)	***2250000***
t (in)	***11.625***

*These values are assumed unless noted otherwise in table below.

General Information			Variations from Base Values (0 if none)			Fixed Condition		Cantilever Condition	
Pier	H (ft)	L (ft)	t (in)	E (psi)	h/d	Delta	R	Delta	R
5.33	***8.7***	***5.33***			1.63	0.92	1.08	2.23	0.45
4.67	***8.7***	***4.67***			1.86	1.21	0.83	3.15	0.32
12	***6***	***12***			0.50	0.16	6.15	0.20	5.00
12	***13.3***	***12***			1.11	0.47	2.13	0.88	1.14
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!



Shear Stress Design at Piers

Fs (psi)	***32000***	
f'm (psi)	***2500***	
fy (psi)	***60000***	
Es (psi)	***29000000***	
S_{ds}	***1.34***	
Av (in^2)	***0.31***	Horiz Bar Area
Fb (psi)	1125	
Em (psi)	2250000	
n	12.9	

Seismic Forces		0.7E Height Above Wall Base (ft)
Roof 0.7E (lb)	***26500***	***32***
2nd Flr 0.7E (lb)	***800***	***17***
Wall 0.7E (lb)	***54200***	***18***

Input								Calculations													
Pier	H (ft)	L (ft) = d_v	d (ft)	t (in) = b	Fixed ("F") or Cantilever ("C")	R	P due to DL (lbs)	% of V	Vi (lb) due to .7E	M (lb-ft)	M/(Vd_v)	P_{min}(.6-.14Sds)D, lbs	fv (psi)	Fvm (psi) by Eq. 8-23	Shear Steel Req'd?	Horiz Bar Spacing if Req'd (in)	Fvs (psi)	Fv Max, psi	Fv, psi	Check	V/($F_{vm}A_{mv}$)
5.33	***8.7***	***5.33***	***4.7***	***11.625***	***f***	***1.08***	***24465***	11	8643	37598	0.82	10089	23.2	67.0	No	***24.0***	17.8	112.3	84.8	OK	0.17
4.67	***8.7***	***4.67***	***4***	***11.625***	***f***	***0.83***	***21435***	8	6629	28837	0.93	8840	20.4	62.0	No	***24.0***	17.8	104.6	79.7	OK	0.16
12	***6***	***12***	***11.3***	***11.625***	***f***	***6.15***	***55080***	60	49176	147529	0.25	22715	58.8	91.8	No	***24.0***	17.8	150.0	109.6	OK	0.32
12	***13.3***	***12***	***11.3***	***11.625***	***f***	***2.13***	***55080***	21	17051	113392	0.55	22714.99	20.4	78.5	No	***24.0***	17.8	129.7	96.2	OK	0.13
								0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	***24.0***	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					Sum	10.1988															

SHEARWALL PIER CRACKING CHECK

For similar sample calculation reference pg. 20-51 and 20-56 of TMS's "Masonry Designers Guide 2022"

Input Shaded Cells

								Masonry Stress Values					Steel Stress Values		TMS 402, Sec. 8.3.4.4 Check			
Pier	A (in^2)	S (in^3)	f (psi)	Crack Check	Approx. Jamb Stl Req'd (in^2) = M/(Fsjd)	Min Selected As (in^2)	ρ	nρ	k	j	f_b (psi)	f_b Check	fs (psi)	fs Check	M/Vd	Axial Limit (lb)	ρ_{max}	Check
5.33	744	7926	-43	Cracked	0.28	***0.88***	0.0013	0.0173	0.17	0.94	28.1	≤Fb, OK	9635	≤Fs, OK	0.93	92942	0.0073	OK
4.67	651	6085	-43	Cracked	0.25	***0.88***	0.0016	0.0203	0.18	0.94	28.4	≤Fb, OK	8722	≤Fs, OK	1.09	81433	0.0073	OK
12	1674	40176	-30.50	Cracked	0.45	***0.88***	0.0006	0.0072	0.11	0.96	27.1	≤Fb, OK	15417	≤Fs, OK	0.27	209250	0.0073	OK
12	1674	40176	-20.30	Cracked	0.35	***0.88***	0.0006	0.0072	0.11	0.96	24.16804	≤Fb, OK	11849	≤Fs, OK	0.59	209250	0.0073	OK
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	***0***	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA

Solid Grouted CMU Shearwall Analysis (Tall Wall With Openings)

Description:	Grid 4 Wall
Engineer:	JW
Date:	8/18/2026

Opening Pier Rigidity for Shearwall Analysis

Values for Relative Rigidity Calcs.

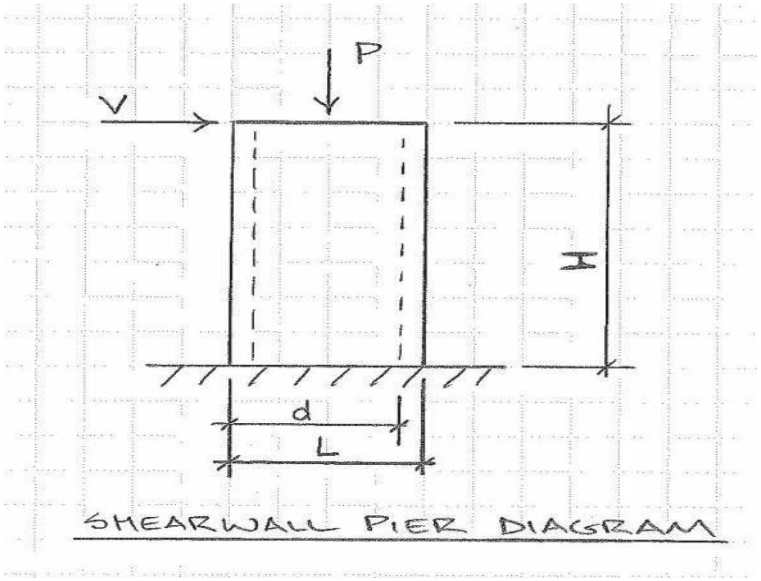
V (lb)	100000
Em (psi)	1000000
t (in)	1

Base values for wall variation modifications*

fm (psi)	2500
Em (psi)	2250000
t (in)	11.625

*These values are assumed unless noted otherwise in table below.

General Information			Variations from Base Values (0 if none)			Fixed Condition		Cantilever Condition	
Pier	H (ft)	L (ft)	t (in)	E (psi)	h/d	Delta	R	Delta	R
8.7	13.3	8.7			1.53	0.82	1.23	1.89	0.53
16	5.3	16			0.33	0.10	9.71	0.11	8.78
5.3	5.3	5.3			1.00	0.40	2.50	0.70	1.43
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!



Shear Stress Design at Piers

Fs (psi)	32000	
f'm (psi)	2500	
fy (psi)	60000	
Es (psi)	29000000	
S_{ds}	1.34	
Av (in^2)	0.31	Horiz Bar Area
Fb (psi)	1125	
Em (psi)	2250000	
n	12.9	

Seismic Forces		0.7E Height Above Wall Base (ft)
Roof 0.7E (lb)	5500	32
2nd Flr 0.7E (lb)	800	17
Wall 0.7E (lb)	39400	18

Input								Calculations												
Pier	H (ft)	L (ft) = d_v	d (ft)	t (in) = b	Fixed ("F") or Cantilever ("C")	R	P due to DL (lbs)	% of V	Vi (lb) due to .7E	M (lb-ft)	M/(Vd_v)	P_{min}(.6-.14Sds)D, lbs	fv (psi)	Fvm (psi) by Eq. 8-23	Shear Steel Req'd?	Horiz Bar Spacing if Req'd (in)	Fvs (psi)	Fv Max, psi	Fv, psi	Check	V/($F_{vm}A_{mv}$)
8.7	13.3	8.7	8.3	11.625	f	1.23	37584	9	4170	27728	0.76	15500	6.9	69.1	No	24.0	17.8	115.7	86.9	OK	0.05
16	5.3	16	5	11.625	f	9.71	58800	72	33026	87518	0.17	24249	29.6	94.9	No	24.0	17.8	150.0	112.7	OK	0.16
5.3	5.3	5.3	5	11.625	f	2.50	10600	19	8505	22538	0.50	4371	23.0	79.3	No	24.0	17.8	133.3	97.1	OK	0.15
								0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
								0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					Sum	13.433478															

SHEARWALL PIER CRACKING CHECK

For similar sample calculation reference pg. 20-51 and 20-56 of TMS's "Masonry Designers Guide 2022"

Input Shaded Cells

								Masonry Stress Values						Steel Stress Values		TMS 402, Sec. 8.3.4.4 Check			
Pier	A (in^2)	S (in^3)	f (psi)	Crack Check	Approx. Jamb Stl Req'd (in^2) = M/(Fsjd)	Min Selected As (in^2)	ρ	nρ	k	j	f_b (psi)	f_b Check	fs (psi)	fs Check	M/Vd	Axial Limit (lb)	ρ_{max}	Check
8.7	1214	21118	-3	Cracked	0.12	0.88	0.0008	0.0098	0.13	0.96	17.2	≤Fb, OK	3969	≤Fs, OK	0.80	151706	0.0073	OK
16	2232	71424	-4	Cracked	0.61	0.88	0.0013	0.0163	0.16	0.95	61.6	≤Fb, OK	21047	≤Fs, OK	0.53	279000	0.0073	OK
5.3	739	7837	-28.60	Cracked	0.16	0.88	0.0013	0.0163	0.16	0.95	13.2	≤Fb, OK	5420	≤Fs, OK	0.53	92419	0.0073	OK
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA

Solid Grouted CMU Shearwall Analysis (Tall Wall With Openings)

Description:	Grid A Wall
Engineer:	JW
Date:	8/18/2026

Opening Pier Rigidity for Shearwall Analysis

Values for Relative Rigidity Calcs.

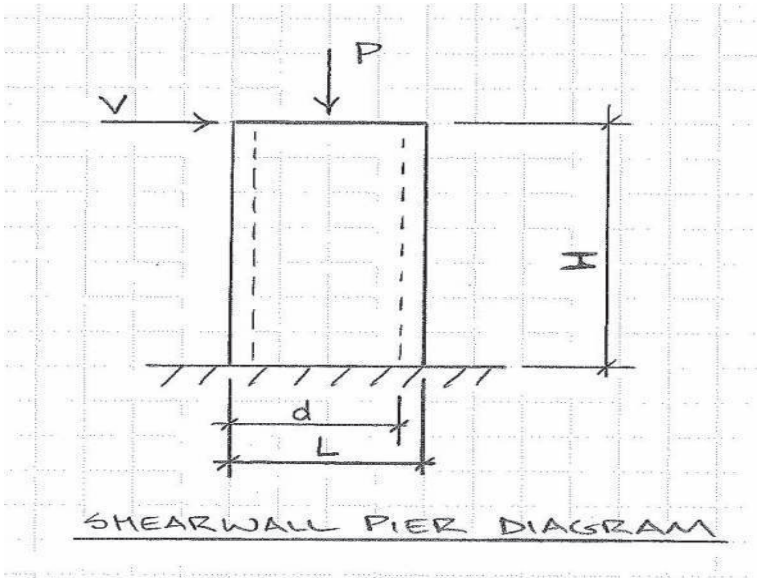
V (lb)	100000
Em (psi)	1000000
t (in)	1

Base values for wall variation modifications*

fm (psi)	2500
Em (psi)	2250000
t (in)	11.625

*These values are assumed unless noted otherwise in table below.

General Information			Variations from Base Values (0 if none)			Fixed Condition		Cantilever Condition	
Pier	H (ft)	L (ft)	t (in)	E (psi)	h/d	Delta	R	Delta	R
7.33	13.3	7.33			1.81	1.14	0.88	2.93	0.34
3.33	13.3	3.33			3.99	7.57	0.13	26.68	0.04
16	13.3	16			0.83	0.31	3.26	0.48	2.09
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!



Shear Stress Design at Piers

Fs (psi)	32000	
f'm (psi)	2500	
fy (psi)	60000	
Es (psi)	29000000	
S_{ds}	1.34	
Av (in^2)	0.31	Horiz Bar Area
Fb (psi)	1125	
Em (psi)	2250000	
n	12.9	

Seismic Forces		0.7E Height Above Wall Base (ft)
Roof 0.7E (lb)	5300	32
2nd Flr 0.7E (lb)	0	
Wall 0.7E (lb)	39800	18

Input								Calculations													
Pier	H (ft)	L (ft) = d_v	d (ft)	t (in) = b	Fixed ("F") or Cantilever ("C")	R	P due to DL (lbs)	% of V	Vi (lb) due to .7E	M (lb-ft)	M/(Vd_v)	P_{min}(.6-.14Sds)D, lbs	fv (psi)	Fvm (psi) by Eq. 8-23	Shear Steel Req'd?	Horiz Bar Spacing if Req'd (in)	Fvs (psi)	Fv Max, psi	Fv, psi	Check	V/($F_{vm}A_{mv}$)
7.33	13.3	7.33	7	11.625	f	0.88	31666	21	9257	61559	0.91	13059	18.1	62.9	No	24.0	17.8	106.2	80.6	OK	0.14
3.33	13.3	3.33	3	11.625	f	0.13	14386	3	1396	9285	2.00	5933	6.0	58.8	No	24.0	17.8	100.0	76.6	OK	0.05
16	13.3	16	15.67	11.625	f	3.26	69120	76	34447	229071	0.42	28505	30.9	84.4	No	24.0	17.8	139.0	102.1	OK	0.18
0	0	0						0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	0						0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					Sum	4.2673119															

SHEARWALL PIER CRACKING CHECK

For similar sample calculation reference pg. 20-51 and 20-56 of TMS's "Masonry Designers Guide 2022"

Input Shaded Cells

								Masonry Stress Values						Steel Stress Values		TMS 402, Sec. 8.3.4.4 Check			
Pier	A (in^2)	S (in^3)	f (psi)	Crack Check	Approx. Jamb Stl Req'd (in^2) = M/(Fsjd)	Min Selected As (in^2)	ρ	nρ	k	j	f_b (psi)	f_b Check	fs (psi)	fs Check	M/Vd	Axial Limit (lb)	ρ_{max}	Check
7.33	1023	14990	-37	Cracked	0.31	0.88	0.0009	0.0116	0.14	0.95	24.5	≤Fb, OK	10487	≤Fs, OK	0.95	127817	0.0073	OK
3.33	465	3094	-23	Cracked	0.11	0.88	0.0021	0.0271	0.21	0.93	20.6	≤Fb, OK	3778	≤Fs, OK	2.22	58067	0.0073	OK
16	2232	71424	-25.72	Cracked	0.51	0.88	0.0004	0.0052	0.10	0.97	24.9	≤Fb, OK	17166	≤Fs, OK	0.42	279000	0.0073	OK
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA

Solid Grouted CMU Shearwall Analysis (Tall Wall With Openings)

Description:	Grid B Wall
Engineer:	JW
Date:	8/18/2026

Opening Pier Rigidity for Shearwall Analysis

Values for Relative Rigidity Calcs.

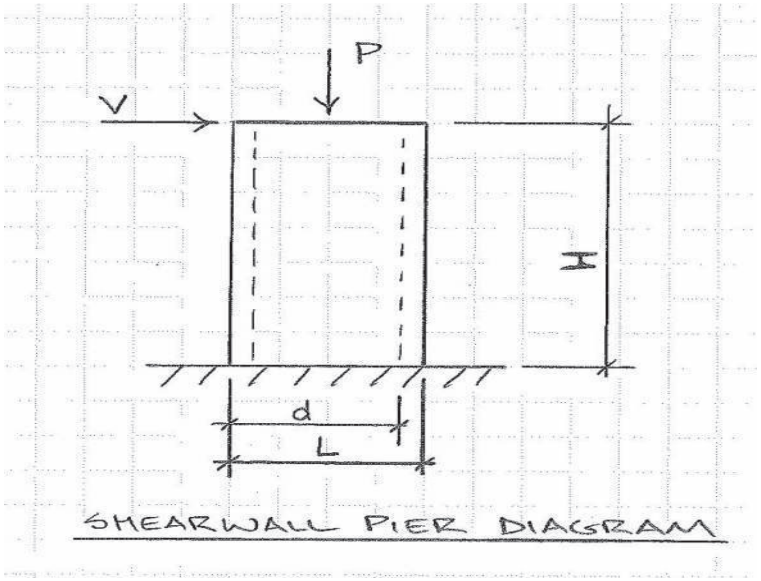
V (lb)	100000
Em (psi)	1000000
t (in)	1

Base values for wall variation modifications*

fm (psi)	2500
Em (psi)	2250000
t (in)	11.625

*These values are assumed unless noted otherwise in table below.

General Information			Variations from Base Values (0 if none)			Fixed Condition		Cantilever Condition	
Pier	H (ft)	L (ft)	t (in)	E (psi)	h/d	Delta	R	Delta	R
35	33	35			0.94	0.37	2.73	0.62	1.62
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!



Shear Stress Design at Piers

Fs (psi)	32000	
f'm (psi)	2500	
fy (psi)	60000	
Es (psi)	29000000	
S_{ds}	1.34	
Av (in^2)	0.31	Horiz Bar Area
Fb (psi)	1125	
Em (psi)	2250000	
n	12.9	

Seismic Forces		0.7E Height Above Wall Base (ft)
Roof 0.7E (lb)	51000	33
2nd Flr 0.7E (lb)	0	
Wall 0.7E (lb)	54200	19

Input								Calculations													
Pier	H (ft)	L (ft) = d_v	d (ft)	t (in) = b	Fixed ("F") or Cantilever ("C")	R	P due to DL (lbs)	% of V	Vi (lb) due to .7E	M (lb-ft)	M/(Vd_v)	P_{min}(.6-.14Sds)D, lbs	fv (psi)	Fvm (psi) by Eq. 8-23	Shear Steel Req'd?	Horiz Bar Spacing if Req'd (in)	Fvs (psi)	Fv Max, psi	Fv, psi	Check	V/($F_{vm}A_{mv}$)
35	33	35	35	11.625	c	1.62	151200	100	105200	3471600	0.94	62355	43.1	61.3	No	24.0	17.8	103.8	79.1	OK	0.35
0	0	0						0	0	0	#DIV/0!	0	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	0						0	0	0	#DIV/0!	0	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	0						0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	0						0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					Sum	1.6177841															

SHEARWALL PIER CRACKING CHECK

For similar sample calculation reference pg. 20-51 and 20-56 of TMS's "Masonry Designers Guide 2022"

Input Shaded Cells

								Masonry Stress Values					Steel Stress Values		TMS 402, Sec. 8.3.4.4 Check			
Pier	A (in^2)	S (in^3)	f (psi)	Crack Check	Approx. Jamb Stl Req'd (in^2) = M/(Fsjd)	Min Selected As (in^2)	ρ	nρ	k	j	f_b (psi)	f_b Check	fs (psi)	fs Check	M/Vd	Axial Limit (lb)	$ρ_{max}$	Check
35	4883	341775	-109	Cracked	3.44	3.52	0.0007	0.0093	0.13	0.96	40.5	≤Fb, OK	29428	≤Fs, OK	0.94	610313	0.0073	OK
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA

Solid Grouted CMU Shearwall Analysis (Tall Wall With Openings)

Description:	Grid C Wall
Engineer:	JW
Date:	8/18/2026

Opening Pier Rigidity for Shearwall Analysis

Values for Relative Rigidity Calcs.

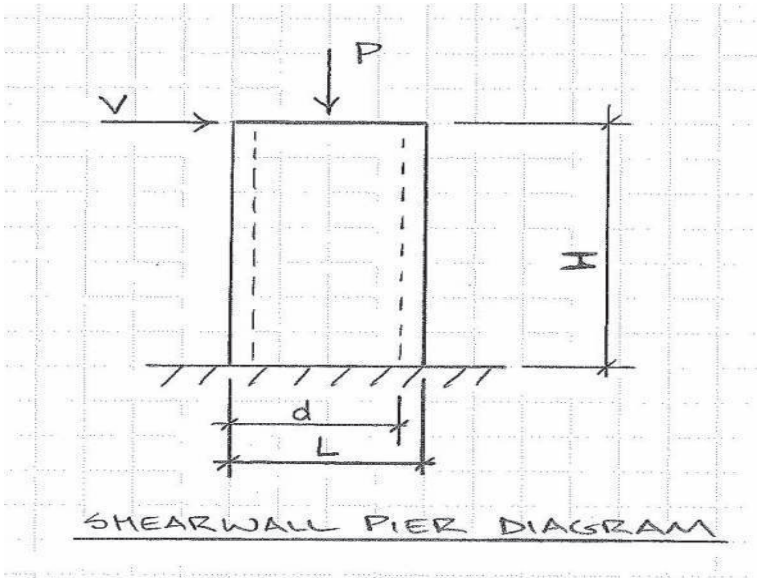
V (lb)	100000
Em (psi)	1000000
t (in)	1

Base values for wall variation modifications*

fm (psi)	2500
Em (psi)	2250000
t (in)	11.625

*These values are assumed unless noted otherwise in table below.

General Information			Variations from Base Values (0 if none)			Fixed Condition		Cantilever Condition	
Pier	H (ft)	L (ft)	t (in)	E (psi)	h/d	Delta	R	Delta	R
35	33	35			0.94	0.37	2.73	0.62	1.62
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!



Shear Stress Design at Piers

Fs (psi)	32000	
f'm (psi)	2500	
fy (psi)	60000	
Es (psi)	29000000	
S_{ds}	1.34	
Av (in^2)	0.31	Horiz Bar Area
Fb (psi)	1125	
Em (psi)	2250000	
n	12.9	

Seismic Forces		0.7E Height Above Wall Base (ft)
Roof 0.7E (lb)	48200	33
2nd Flr 0.7E (lb)	0	
Wall 0.7E (lb)	54200	19

Input								Calculations													
Pier	H (ft)	L (ft) = d_v	d (ft)	t (in) = b	Fixed ("F") or Cantilever ("C")	R	P due to DL (lbs)	% of V	Vi (lb) due to .7E	M (lb-ft)	M/(Vd_v)	P_{min}(.6-.14Sds)D, lbs	fv (psi)	Fvm (psi) by Eq. 8-23	Shear Steel Req'd?	Horiz Bar Spacing if Req'd (in)	Fvs (psi)	Fv Max, psi	Fv, psi	Check	V/($F_{vm}A_{mv}$)
35	33	35	35	11.625	c	1.62	151200	100	102400	3379200	0.94	62355	41.9	61.3	No	24.0	17.8	103.8	79.1	OK	0.34
0	0	0						0	0	0	#DIV/0!	0	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	0						0	0	0	#DIV/0!	0	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	0						0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	0						0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					Sum	1.6177841															

SHEARWALL PIER CRACKING CHECK

For similar sample calculation reference pg. 20-51 and 20-56 of TMS's "Masonry Designers Guide 2022"

Input Shaded Cells

								Masonry Stress Values					Steel Stress Values		TMS 402, Sec. 8.3.4.4 Check			
Pier	A (in^2)	S (in^3)	f (psi)	Crack Check	Approx. Jamb Stl Req'd (in^2) = M/(Fsjd)	Min Selected As (in^2)	ρ	np	k	j	f_b (psi)	f_b Check	fs (psi)	fs Check	M/Vd	Axial Limit (lb)	ρ_{max}	Check
35	4883	341775	-106	Cracked	3.35	3.52	0.0007	0.0093	0.13	0.96	39.8	≤Fb, OK	28645	≤Fs, OK	0.94	610313	0.0073	OK
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA

Solid Grouted CMU Shearwall Analysis (Tall Wall With Openings)

Description:	Grid D Wall
Engineer:	JW
Date:	8/18/2026

Opening Pier Rigidity for Shearwall Analysis

Values for Relative Rigidity Calcs.

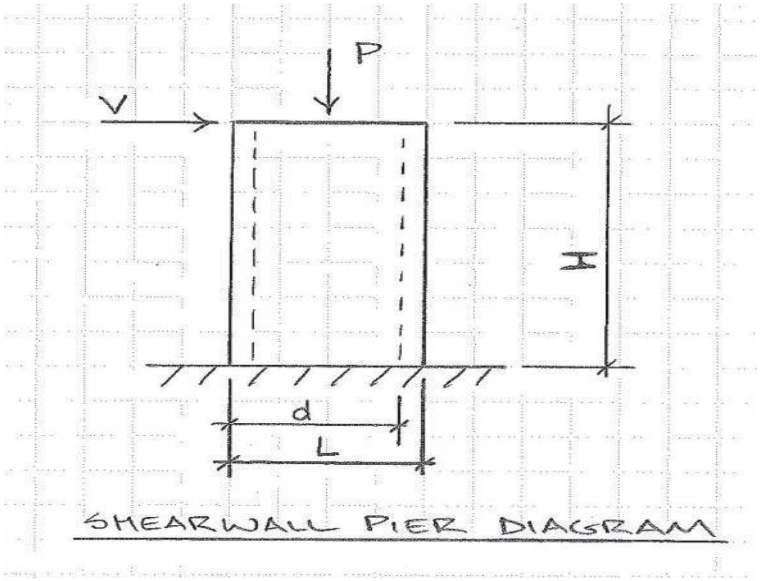
V (lb)	100000
Em (psi)	1000000
t (in)	1

Base values for wall variation modifications*

fm (psi)	2500
Em (psi)	2250000
t (in)	11.625

*These values are assumed unless noted otherwise in table below.

General Information			Variations from Base Values (0 if none)			Fixed Condition		Cantilever Condition	
Pier	H (ft)	L (ft)	t (in)	E (psi)	h/d	Delta	R	Delta	R
6.7	13.3	6.7			1.99	1.38	0.73	3.72	0.27
12.7	13.3	12.7			1.05	0.43	2.33	0.77	1.29
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!



Shear Stress Design at Piers

Fs (psi)	32000	
f'm (psi)	2500	
fy (psi)	60000	
Es (psi)	29000000	
S_{ds}	1.34	
Av (in^2)	0.31	Horiz Bar Area
Fb (psi)	1125	
Em (psi)	2250000	
n	12.9	

Seismic Forces		0.7E Height Above Wall Base (ft)
Roof 0.7E (lb)	5000	32
2nd Flr 0.7E (lb)	0	
Wall 0.7E (lb)	38400	18

Input								Calculations													
Pier	H (ft)	L (ft) = d_v	d (ft)	t (in) = b	Fixed ("F") or Cantilever ("C")	R	P due to DL (lbs)	% of V	Vi (lb) due to .7E	M (lb-ft)	M/(Vd_v)	P_{min}(.6-.14Sds)D, lbs	fv (psi)	Fvm (psi) by Eq. 8-23	Shear Steel Req'd?	Horiz Bar Spacing if Req'd (in)	Fvs (psi)	Fv Max, psi	Fv, psi	Check	V/($F_{vm}A_{mv}$)
6.7	13.3	6.7	6.37	11.625	f	0.73	28944	24	10306	68532	0.99	11937	22.1	59.1	No	24.0	17.8	100.5	76.9	OK	0.19
12.7	13.3	12.7	12.37	11.625	f	2.33	54864	76	33094	220078	0.52	22626	37.4	79.6	No	24.0	17.8	131.8	97.4	OK	0.23
0	0	0						0	0	0	#DIV/0!	0	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	0						0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0	0	0						0	0	0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	24.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
					Sum	3.0566814															

SHEARWALL PIER CRACKING CHECK

For similar sample calculation reference pg. 20-51 and 20-56 of TMS's "Masonry Designers Guide 2022"

Input Shaded Cells

								Masonry Stress Values					Steel Stress Values		TMS 402, Sec. 8.3.4.4 Check			
Pier	A (in^2)	S (in^3)	f (psi)	Crack Check	Approx. Jamb Stl Req'd (in^2) = M/(Fsjd)	Min Selected As (in^2)	ρ	nρ	k	j	f_b (psi)	f_b Check	fs (psi)	fs Check	M/Vd	Axial Limit (lb)	ρ_{max}	Check
6.7	935	12524	-53	Cracked	0.37	0.88	0.0010	0.0128	0.15	0.95	27.8	≤Fb, OK	12858	≤Fs, OK	1.04	116831	0.0073	OK
12.7	1772	45000	-46	Cracked	0.62	0.88	0.0005	0.0066	0.11	0.96	29.6	≤Fb, OK	20974	≤Fs, OK	0.54	221456	0.0073	OK
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA
0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	0	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!	NA	NA	#DIV/0!	NA	NA	NA

100% CD
STRUCTURAL CALCULATIONS

FOR

Washoe County School District

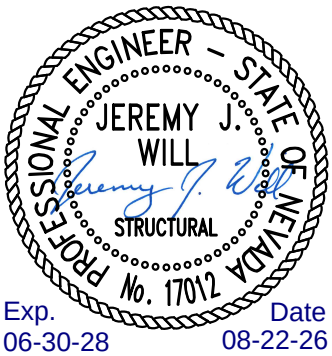
Libby Booth Elementary School
Tenant Improvement

1450 Stewart Street
Reno, NV 89502

For:

H+K Architects
50 Washington Street, Suite 200
Reno, NV 89503

By:



Exp. 06-30-28

Date 08-22-26

Will Engineering LLC
748 S. Meadows Parkway, Suite A-9
PMB #21
Reno, NV 89521
Phone: (775)560-6554

Design Criteria Summary

Code: **2024 IBC**

Structural Risk Category: **III** (IBC Table 1604.5)

Gravity Loads and Masses:

Roof:

Roof Live Load (Lr): **20 psf** (IBC Table 1607.1)

Snow (S): Per ASCE 7-22 Chapter 7.

$p_f = 0.7C_eC_tp_g$:

At Heated Roof: **36.0 psf**

At Unheated Roof: **36.3 psf**

C_e = *0.9* Per ASCE 7-22 Table 7.3-1.

C_t : Per ASCE 7-22 Table 7.3-2 and 7.3-3.

At Heated Roof: *1.19*

At Unheated Roof: *1.20*

p_g = *48* psf

p_m (at roof slope < 15^0) = **35** psf, Per ASCE 7-22 Sec 7.3.3.

$p_{m,max}$ = *35* Per ASCE 7-22 Table 7.3-4.

$p_s = C_sp_f$:

At Heated Roof: **36.0 psf**

At Unheated Roof: **36.3 psf**

C_s = *1.0*

1st Floor:

Live (L) - Per IBC Table 1607.1:

Offices	50.0 psf
Classrooms	40.0 psf
First- Floor Corridors	100.0 psf

(E) Kindergarten Room

Dead (D)

Flooring	2.0 psf
5" Concrete Slab	60.0 psf
Mech/Misc.	3.0 psf
Σ =	**65.0 psf**

Table 1608.2.1 Ground snow loads for Northern Nevada locations

*Add Table **1608.2.1** to read as follows:*

Table 1608.2.1

GROUND SNOW LOADS, Pg, FOR NORTHERN NEVADA LOCATIONS [1,2,3,4]

Elevation (feet)	West of U.S. 395, Eastern Sierra Slope, Carson City, Reno, Washoe County*, Douglas County and West of S.R. 88.[1]				East of U.S. 395 for Carson City, Reno, Sparks, Washoe County*, Douglas County and East of S.R. 88.[1]				Lyon County, City of Fernley				Storey County[1]				All Nevada Counties*, Lake Tahoe Basin, Western Sierra Slope			
	RISK CATEGORY																			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
	Pg (Pounds Per Square Foot)																			
4500	35	43	48	52	35	43	48	52	12	15	16	18	12	15	16	18				
5000	35	43	48	52	35	43	48	52	35	43	48	52	12	15	16	18				
5100	47	59	65	71	36	45	49	54	36	45	49	54	12	15	16	18				
5200	60	75	82	90	38	48	52	57	36	45	49	54	12	15	16	18				
5300	74	92	101	110	39	49	54	59	39	49	54	59	12	15	16	18				
5400	86	108	118	129	40	50	55	60	40	50	55	60	12	15	16	18				
5500	99	123	136	148	43	53	59	64	43	53	59	64	58	72	79	86				
6000	163	203	224	244	50	62	68	74	50	62	68	74	80	100	110	120	252	315	346	378
6500	196	245	269	294	50	62	68	74	50	62	68	74	103	129	142	155	269	336	370	403
7000	229	286	315	343	66	82	90	98	66	82	90	98	103	129	142	155	286	358	393	429
7500	246	308	338	369	66	82	90	98	66	82	90	98	103	129	142	155	303	379	417	455
8000	262	328	360	393	99	123	136	148	99	123	136	148	103	129	142	155	320	400	440	480
8500	278	348	382	417	99	123	136	148	99	123	136	148	103	129	142	155	338	422	464	506
9000	310	388	426	465	131	163	180	196	131	163	180	196	131	163	180	196	378	472	519	566
9500	343	429	472	515	163	203	224	244	163	203	224	244	138	172	189	206	446	558	613	669
10000	408	510	561	612	163	203	224	244	163	203	224	244	163	203	224	244	480	600	660	720

Footnotes:

1. Final roof snow design load Ps or Pf shall not be less than 29 psf

2. Refer to local jurisdiction ordinances for other Ground Snow Load information S.R. = State Route

3. Intermediate values may be determined by interpolation U.S. = U.S. Highway

4. The City of Elko shall not have ground snow loads less than 30 psf and Churchill County shall not have ground snow loads less than 20 psf

* Ground snow loads in Washoe County shall be taken from Tables 1608.2.1 or the ASCE Hazard Tool. Ground snow loads from the ASCE Hazard tool shall use the ASCE/SEI 7-22 standard. The minimum ground snow load for a structure shall not be less than the lower of the two values from Table 1608.2.1 and the ASCE Hazard Tool.

Table 1609.3.2 Special wind region defined: minimum basic wind speeds

*Add Table **1609.3.2** to read as follows:*

TABLE 1609.3.2
SPECIAL WIND REGION DEFINED:
MINIMUM BASIC WIND SPEEDS

For Carson City, City of Reno, City of Sparks, Douglas, Lyon, Storey and Washoe Counties the design wind speed values shall be:

Risk Category	Ultimate Wind Speed V_{ult} (mph)	V_{asd} Wind Speed 3-sec gust (mph)
I	110	85
II & 2024 IRC	120	93
III	130	101
IV	135	104

Table notes:

a) Air density corrections to design wind pressures are prohibited. The conversions from Vult to Vasd are based on Table 1609.3.1

Section 1704.2 Special inspections and tests

*Amend Section **1704.2** to read as follows:*

1704.2 Special inspections and tests. Where application is made to the *building official* for construction as specified in Section 105, the *owner* or the *owner's* authorized agent, other than the contractor, shall employ one or more *approved agencies* to provide *special inspections* and tests during construction on the types of work specified in Section 1705 and identify the *approved agencies* to the *building official*. These *special inspections* and tests are in addition to the inspections by the *building official* that are identified in Section 110.

Exceptions:

1. *Special inspections* and tests are not required for construction of a minor nature or as warranted by conditions in the *jurisdiction* as *approved* by the *building official*.

2. Unless otherwise required by the *building official*, *special inspections* and tests are not required for Group R-3 occupancies as applicable in section 101.2 and Group U occupancies that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.

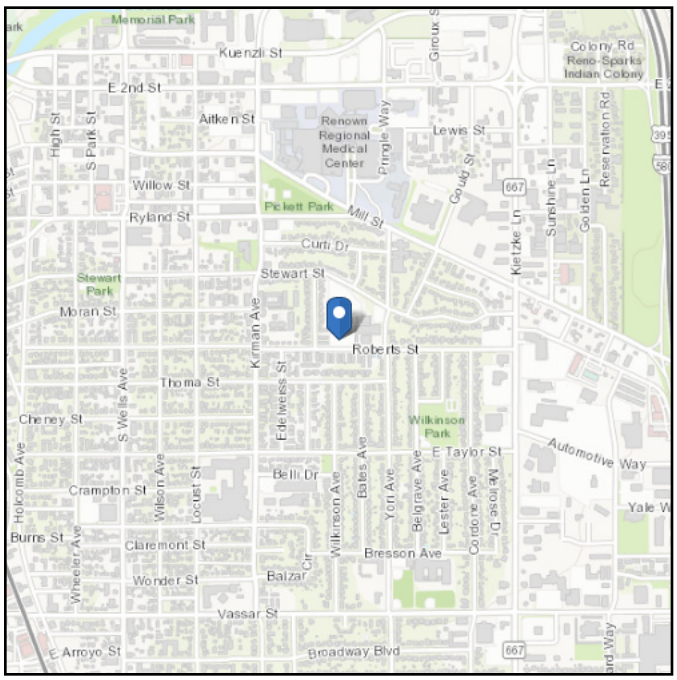
3. *Special inspections* and tests are not required for portions of *structures* designed and constructed in accordance with the cold-formed steel *light-frame construction* provisions of Section 2206.1.2 or the *conventional light-frame constructions* provisions of Section 2308.

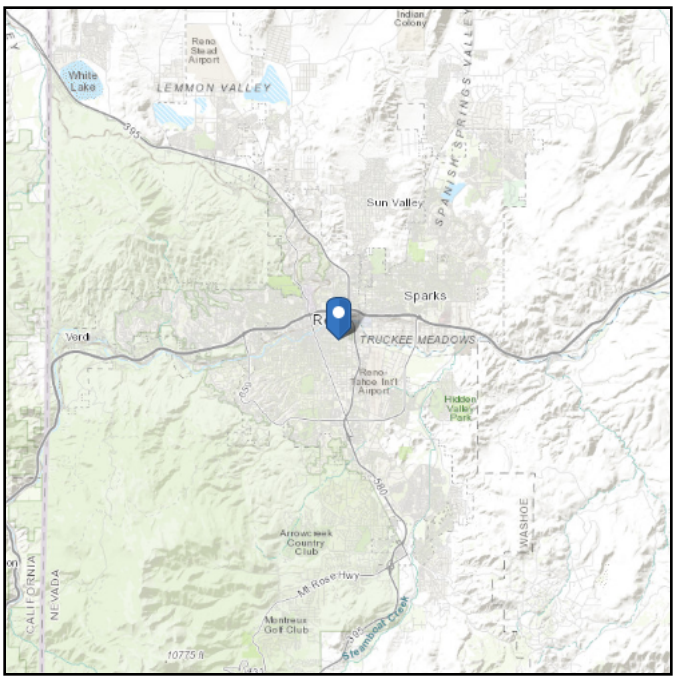
4. The contractor is permitted to employ the *approved agencies* where the contractor is also the *owner*.

ASCE Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-22	**Latitude:**	39.520437
Risk Category:	III	**Longitude:**	-119.795482
Soil Class:	C - Very Dense Soil and Soft Rock	**Elevation:**	4462.300040395303 ft (NAVD 88)





Seismic

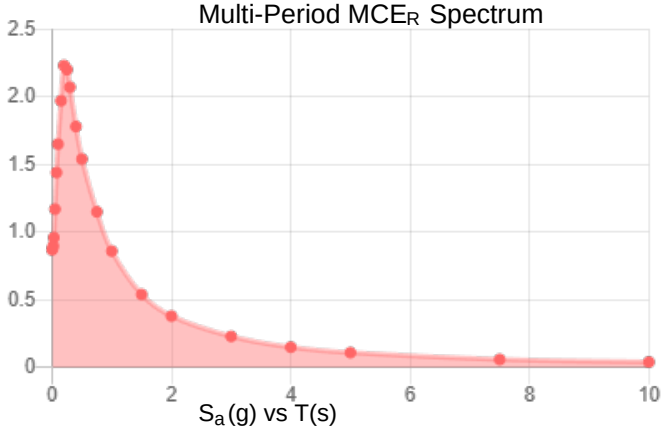
Site Soil Class: C - Very Dense Soil and Soft Rock

Results:

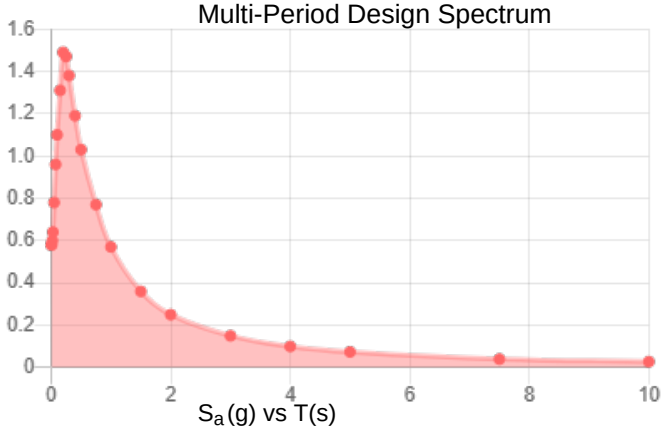
PGA_M :	0.73	T_L :	6
S_{MS} :	2.01	S_S :	1.96
S_{M1} :	0.86	S_1 :	0.6
S_{DS} :	1.34	V_{S30} :	530
S_{D1} :	0.57		

Seismic Design Category: D

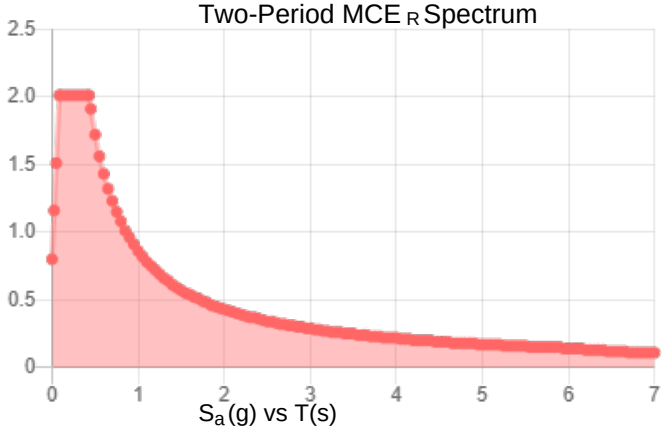
Multi-Period MCE_R Spectrum



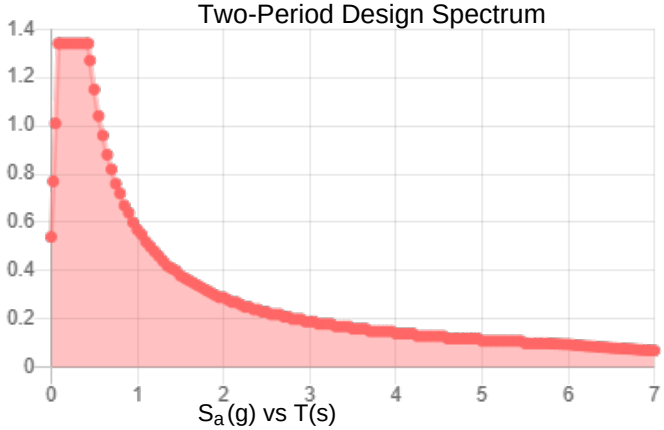
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Tue Feb 24 2026**

Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

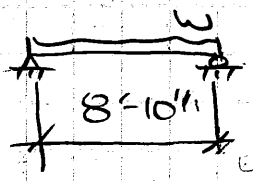
The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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CHECK CAPACITY OF (E) KINDERGARTEN FLR SLAB TO SUPPORT (N) LOADS

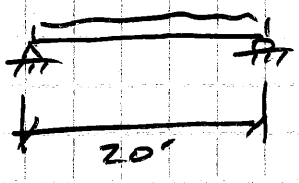
PER ORIG DWGS:
(E) SLAB IS 5" THICK W/ #5 AT 12" O.C. AT BOTTOM. ASSUME f'_c = 3ksi AND F_y = 36 ksi



w_D = 65 PSF
w_L = 100 PSF

CC = 0.79 < 1, OK.

CHECK (E) BEAMS



w_D = 9.33'(65 PSF) + 1'(0.42')145 PCF
= 472 PLF
w_L = 9.33'(100 PSF) = 933 PLF

PER ORIG DWGS:
(E) BEAMS ARE 12" W x 1'-10" D W/ (3) #8 CONT T+B. ASSUME f'_c = 3ksi AND F_y = 36 ksi

CC = 0.90 < 1, OK.

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: (E) Kindergarten Floor Slab

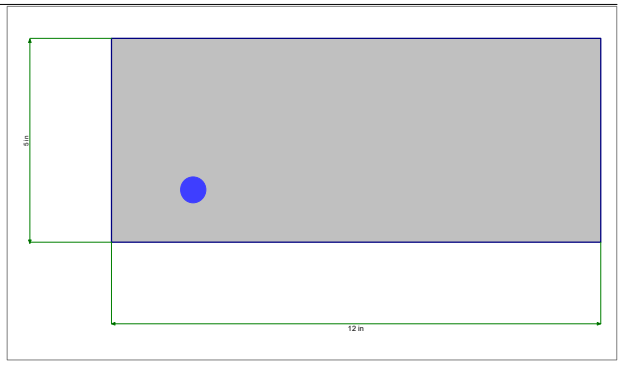
Code References

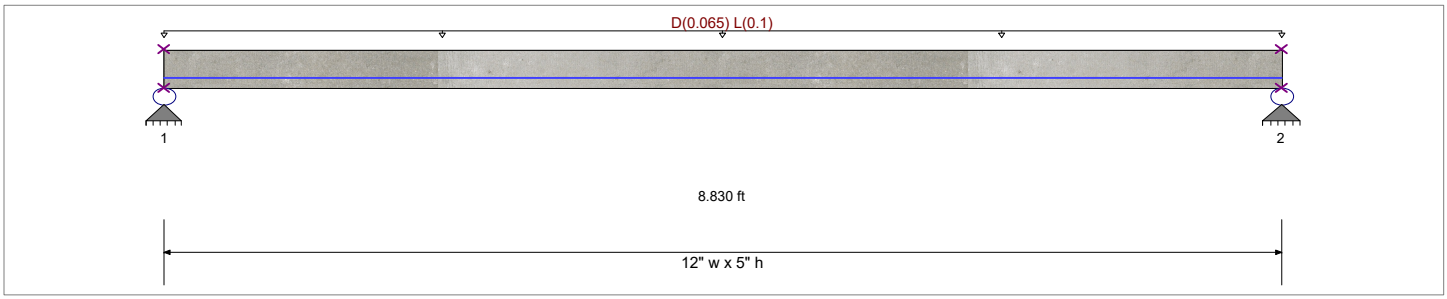
Governing Code : IBC 2024
Referenced Design Standard(s) : ACI 318-19
Load Combination Set : ASCE 7-22 / IBC 2024

General Information

f'c	=	3.0 ksi	ϕ Phi Values	Flexure :	0.90
fr =7.5 * λ * f'c $^{1/2}$	=	410.792 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		36.0 ksi
fy - Main Rebar	=	36.0	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2

Seismic Design Category = A





Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 5.0 in
Span #1 Reinforcing....
1-#5 at 1.310 in from Bottom, from 0.0 to 8.830 ft in this span

Load for Span Number 1
Uniform Load : D = 0.0650, L = 0.10 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = **0.790** : 1

Section used for this span	**Typical Section**		
Mu : Applied	2.320 k-ft		
Mn * Phi : Allowable	2.936 k-ft		
Location of maximum on span	4.423 ft		
Span # where maximum occurs	Span # 1		

Design Limits

Tensile Strain >= Min Strain Limit (Section 9.3.3.1)
0.02276 in / in >= 0.00424 in / in OK

As Provided >= As,min (Section 9.6.1.2)
0.310 in^2 >= 0.277 in^2 OK

Maximum Deflection

Max Downward Transient Deflection	0.035 in	Ratio =	3024 >=360.0	L Only
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0	L Only
Max Downward Total Deflection	0.140 in	Ratio =	756 >=240.0	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : +D+L

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.728	0.728
Max Upward from Load Combinations	0.728	0.728
Max Upward from Load Cases	0.442	0.442
D Only	0.287	0.287
+D+L	0.728	0.728

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: (E) Kindergarten Floor Slab

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+D+0.750L	0.618	0.618
+0.60D	0.172	0.172
L Only	0.442	0.442

Shear Stirrup Requirements

Entire Beam Span Length : Ties Not Req'd, Stirrups are not required.

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60L	1	0.00	3.69	1.05	No	N/A	2.78	0.00	2.78	0.377	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.10	3.69	1.03	No	N/A	2.78	0.00	2.78	0.369	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.19	3.69	1.00	No	N/A	2.78	0.00	2.78	0.361	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.29	3.69	0.98	No	N/A	2.78	0.00	2.78	0.353	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.39	3.69	0.96	No	N/A	2.78	0.00	2.78	0.344	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.48	3.69	0.94	No	N/A	2.78	0.00	2.78	0.336	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.58	3.69	0.91	No	N/A	2.78	0.00	2.78	0.328	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.68	3.69	0.89	No	N/A	2.78	0.00	2.78	0.320	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.77	3.69	0.87	No	N/A	2.78	0.00	2.78	0.311	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.87	3.69	0.84	No	N/A	2.78	0.00	2.78	0.303	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	0.97	3.69	0.82	No	N/A	2.78	0.00	2.78	0.295	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.06	3.69	0.80	No	N/A	2.78	0.00	2.78	0.287	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.16	3.69	0.78	No	N/A	2.78	0.00	2.78	0.278	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.25	3.69	0.75	No	N/A	2.78	0.00	2.78	0.270	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.35	3.69	0.73	No	N/A	2.78	0.00	2.78	0.262	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.45	3.69	0.71	No	N/A	2.78	0.00	2.78	0.254	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.54	3.69	0.68	No	N/A	2.78	0.00	2.78	0.245	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.64	3.69	0.66	No	N/A	2.78	0.00	2.78	0.237	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.74	3.69	0.64	No	N/A	2.78	0.00	2.78	0.229	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.83	3.69	0.61	No	N/A	2.78	0.00	2.78	0.221	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	1.93	3.69	0.59	No	N/A	2.78	0.00	2.78	0.212	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.03	3.69	0.57	No	N/A	2.78	0.00	2.78	0.204	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.12	3.69	0.55	No	N/A	2.78	0.00	2.78	0.196	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.22	3.69	0.52	No	N/A	2.78	0.00	2.78	0.188	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.32	3.69	0.50	No	N/A	2.78	0.00	2.78	0.179	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.41	3.69	0.48	No	N/A	2.78	0.00	2.78	0.171	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.51	3.69	0.45	No	N/A	2.78	0.00	2.78	0.163	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.61	3.69	0.43	No	N/A	2.78	0.00	2.78	0.155	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.70	3.69	0.41	No	N/A	2.78	0.00	2.78	0.146	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.80	3.69	0.38	No	N/A	2.78	0.00	2.78	0.138	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.90	3.69	0.36	No	N/A	2.78	0.00	2.78	0.130	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	2.99	3.69	0.34	No	N/A	2.78	0.00	2.78	0.122	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.09	3.69	0.32	No	N/A	2.78	0.00	2.78	0.113	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.18	3.69	0.29	No	N/A	2.78	0.00	2.78	0.105	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.28	3.69	0.27	No	N/A	2.78	0.00	2.78	0.097	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.38	3.69	0.25	No	N/A	2.78	0.00	2.78	0.089	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.47	3.69	0.22	No	N/A	2.78	0.00	2.78	0.080	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.57	3.69	0.20	No	N/A	2.78	0.00	2.78	0.072	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.67	3.69	0.18	No	N/A	2.78	0.00	2.78	0.064	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.76	3.69	0.16	No	N/A	2.78	0.00	2.78	0.056	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.86	3.69	0.13	No	N/A	2.78	0.00	2.78	0.047	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	3.96	3.69	0.11	No	N/A	2.78	0.00	2.78	0.039	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.05	3.69	0.09	No	N/A	2.78	0.00	2.78	0.031	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.15	3.69	0.06	No	N/A	2.78	0.00	2.78	0.023	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.25	3.69	0.04	No	N/A	2.78	0.00	2.78	0.014	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.34	3.69	0.02	No	N/A	2.78	0.00	2.78	0.006	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.44	3.69	-0.01	No	N/A	2.78	0.00	2.78	0.002	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.54	3.69	-0.03	No	N/A	2.78	0.00	2.78	0.010	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.63	3.69	-0.05	No	N/A	2.78	0.00	2.78	0.019	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.73	3.69	-0.07	No	N/A	2.78	0.00	2.78	0.027	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.83	3.69	-0.10	No	N/A	2.78	0.00	2.78	0.035	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	4.92	3.69	-0.12	No	N/A	2.78	0.00	2.78	0.043	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.02	3.69	-0.14	No	N/A	2.78	0.00	2.78	0.052	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.11	3.69	-0.17	No	N/A	2.78	0.00	2.78	0.060	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.21	3.69	-0.19	No	N/A	2.78	0.00	2.78	0.068	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.31	3.69	-0.21	No	N/A	2.78	0.00	2.78	0.076	Eqn (b)	Ties Not Req'd

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: (E) Kindergarten Floor Slab

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60L	1	5.40	3.69	-0.24	No	N/A	2.78	0.00	2.78	0.085	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.50	3.69	-0.26	No	N/A	2.78	0.00	2.78	0.093	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.60	3.69	-0.28	No	N/A	2.78	0.00	2.78	0.101	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.69	3.69	-0.30	No	N/A	2.78	0.00	2.78	0.109	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.79	3.69	-0.33	No	N/A	2.78	0.00	2.78	0.118	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.89	3.69	-0.35	No	N/A	2.78	0.00	2.78	0.126	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	5.98	3.69	-0.37	No	N/A	2.78	0.00	2.78	0.134	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.08	3.69	-0.40	No	N/A	2.78	0.00	2.78	0.142	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.18	3.69	-0.42	No	N/A	2.78	0.00	2.78	0.151	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.27	3.69	-0.44	No	N/A	2.78	0.00	2.78	0.159	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.37	3.69	-0.47	No	N/A	2.78	0.00	2.78	0.167	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.47	3.69	-0.49	No	N/A	2.78	0.00	2.78	0.175	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.56	3.69	-0.51	No	N/A	2.78	0.00	2.78	0.184	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.66	3.69	-0.53	No	N/A	2.78	0.00	2.78	0.192	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.76	3.69	-0.56	No	N/A	2.78	0.00	2.78	0.200	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.85	3.69	-0.58	No	N/A	2.78	0.00	2.78	0.208	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	6.95	3.69	-0.60	No	N/A	2.78	0.00	2.78	0.217	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.04	3.69	-0.63	No	N/A	2.78	0.00	2.78	0.225	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.14	3.69	-0.65	No	N/A	2.78	0.00	2.78	0.233	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.24	3.69	-0.67	No	N/A	2.78	0.00	2.78	0.241	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.33	3.69	-0.69	No	N/A	2.78	0.00	2.78	0.250	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.43	3.69	-0.72	No	N/A	2.78	0.00	2.78	0.258	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.53	3.69	-0.74	No	N/A	2.78	0.00	2.78	0.266	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.62	3.69	-0.76	No	N/A	2.78	0.00	2.78	0.274	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.72	3.69	-0.79	No	N/A	2.78	0.00	2.78	0.283	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.82	3.69	-0.81	No	N/A	2.78	0.00	2.78	0.291	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	7.91	3.69	-0.83	No	N/A	2.78	0.00	2.78	0.299	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	8.01	3.69	-0.86	No	N/A	2.78	0.00	2.78	0.307	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	8.11	3.69	-0.88	No	N/A	2.78	0.00	2.78	0.316	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	8.20	3.69	-0.90	No	N/A	2.78	0.00	2.78	0.324	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	8.30	3.69	-0.92	No	N/A	2.78	0.00	2.78	0.332	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	8.40	3.69	-0.95	No	N/A	2.78	0.00	2.78	0.340	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	8.49	3.69	-0.97	No	N/A	2.78	0.00	2.78	0.349	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	8.59	3.69	-0.99	No	N/A	2.78	0.00	2.78	0.357	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	8.69	3.69	-1.02	No	N/A	2.78	0.00	2.78	0.365	Eqn (b)	Ties Not Req'd
+1.20D+1.60L	1	8.78	3.69	-1.04	No	N/A	2.78	0.00	2.78	0.373	Eqn (b)	Ties Not Req'd

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	8.830	2.32	2.94	0.79
+1.40D					
Span # 1	1	8.830	0.89	2.94	0.30
+1.20D+1.60L					
Span # 1	1	8.830	2.32	2.94	0.79
+1.20D+L					
Span # 1	1	8.830	1.73	2.94	0.59
+1.20D					
Span # 1	1	8.830	0.76	2.94	0.26
+0.90D					
Span # 1	1	8.830	0.57	2.94	0.19

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
1	+D+L	0.1400	4.415		0.0000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: (E) Kindergarten Floor Beams

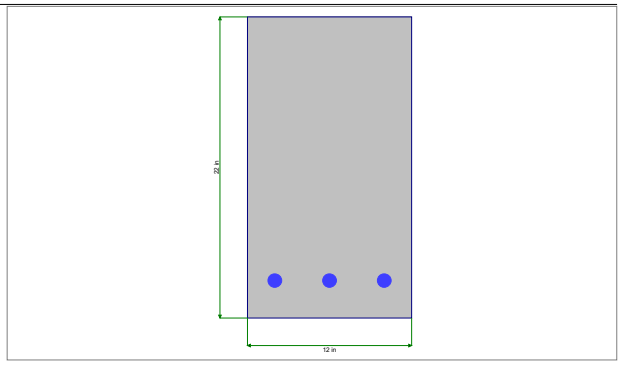
Code References

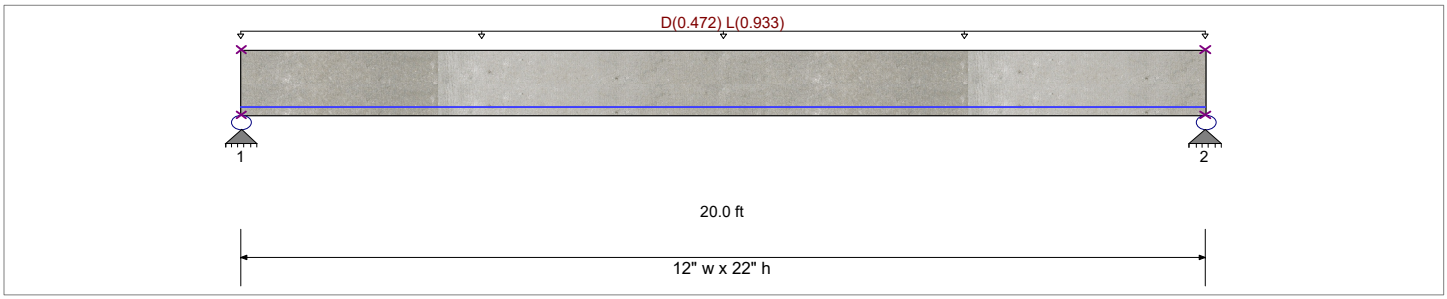
Governing Code : IBC 2024
Referenced Design Standard(s) : ACI 318-19
Load Combination Set : ASCE 7-22 / IBC 2024

General Information

f'c	=	3.0 ksi	ϕ Phi Values	Flexure :	0.90
fr =7.5 * λ * f'c $^{1/2}$	=	410.792 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		36.0 ksi
fy - Main Rebar	=	36.0	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2

Seismic Design Category = A





Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 22.0 in
Span #1 Reinforcing....
3-#8 at 2.750 in from Bottom, from 0.0 to 20.0 ft in this span

Load for Span Number 1
Uniform Load : D = 0.4720, L = 0.9330 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = **0.901** : 1
Section used for this span **Typical Section**
Mu : Applied 102.960 k-ft
Mn * Phi : Allowable 114.260 k-ft
Location of maximum on span 9.982 ft
Span # where maximum occurs Span # 1

Design Limits
Tensile Strain >= Min Strain Limit (Section 9.3.3.1)
0.01459 in / in >= 0.00424 in / in OK
As Provided >= As,min (Section 9.6.1.2)
2.370 in^2 >= 2.357 in^2 OK

Maximum Deflection

Max Downward Transient Deflection	0.188 in	Ratio =	1273 >=360.0	L Only
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0	L Only
Max Downward Total Deflection	0.317 in	Ratio =	756 >=240.0	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : +D+L

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	14.050	14.050
Max Upward from Load Combinations	14.050	14.050
Max Upward from Load Cases	9.330	9.330
D Only	4.720	4.720
+D+L	14.050	14.050

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: (E) Kindergarten Floor Beams

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+D+0.750L	11.717	11.718
+0.60D	2.832	2.832
L Only	9.330	9.330

Shear Stirrup Requirements

Between 0.00 to 5.39 ft, Max spacing per 9.7.6.2.2, use #3 stirrups spaced at 9 in
Between 5.43 to 14.57 ft, Ties Not Req'd, Stirrups are not required.
Between 14.61 to 19.96 ft, Max spacing per 9.7.6.2.2, use #3 stirrups spaced at 9 in

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60L	1	0.00	19.25	20.59	Yes	9.63	18.98	11.88	30.86	0.667	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	0.22	19.25	20.14	Yes	9.63	18.98	11.88	30.86	0.653	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	0.44	19.25	19.69	Yes	9.63	18.98	11.88	30.86	0.638	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	0.66	19.25	19.24	Yes	9.63	18.98	11.88	30.86	0.624	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	0.87	19.25	18.79	Yes	9.63	18.98	11.88	30.86	0.609	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	1.09	19.25	18.34	Yes	9.63	18.98	11.88	30.86	0.594	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	1.31	19.25	17.89	Yes	9.63	18.98	11.88	30.86	0.580	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	1.53	19.25	17.44	Yes	9.63	18.98	11.88	30.86	0.565	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	1.75	19.25	16.99	Yes	9.63	18.98	11.88	30.86	0.551	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	1.97	19.25	16.54	Yes	9.63	18.98	11.88	30.86	0.536	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	2.19	19.25	16.09	Yes	9.63	18.98	11.88	30.86	0.521	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	2.40	19.25	15.64	Yes	9.63	18.98	11.88	30.86	0.507	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	2.62	19.25	15.19	Yes	9.63	18.98	11.88	30.86	0.492	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	2.84	19.25	14.74	Yes	9.63	18.98	11.88	30.86	0.478	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	3.06	19.25	14.29	Yes	9.63	18.98	11.88	30.86	0.463	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	3.28	19.25	13.84	Yes	9.63	18.98	11.88	30.86	0.449	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	3.50	19.25	13.39	Yes	9.63	18.98	11.88	30.86	0.434	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	3.72	19.25	12.94	Yes	9.63	18.98	11.88	30.86	0.419	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	3.93	19.25	12.49	Yes	9.63	18.98	11.88	30.86	0.405	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	4.15	19.25	12.04	Yes	9.63	18.98	11.88	30.86	0.390	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	4.37	19.25	11.59	Yes	9.63	18.98	11.88	30.86	0.376	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	4.59	19.25	11.14	Yes	9.63	18.98	11.88	30.86	0.361	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	4.81	19.25	10.69	Yes	9.63	18.98	11.88	30.86	0.346	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	5.03	19.25	10.24	Yes	9.63	18.98	11.88	30.86	0.332	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	5.25	19.25	9.79	Yes	9.63	18.98	11.88	30.86	0.317	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	5.46	19.25	9.34	No	N/A	13.64	0.00	13.64	0.685	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	5.68	19.25	8.89	No	N/A	13.64	0.00	13.64	0.652	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	5.90	19.25	8.44	No	N/A	13.64	0.00	13.64	0.619	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.12	19.25	7.99	No	N/A	13.64	0.00	13.64	0.586	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.34	19.25	7.54	No	N/A	13.64	0.00	13.64	0.553	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.56	19.25	7.09	No	N/A	13.64	0.00	13.64	0.520	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.78	19.25	6.64	No	N/A	13.64	0.00	13.64	0.487	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.99	19.25	6.19	No	N/A	13.64	0.00	13.64	0.454	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.21	19.25	5.74	No	N/A	13.64	0.00	13.64	0.421	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.43	19.25	5.29	No	N/A	13.64	0.00	13.64	0.388	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.65	19.25	4.84	No	N/A	13.64	0.00	13.64	0.355	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.87	19.25	4.39	No	N/A	13.64	0.00	13.64	0.322	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.09	19.25	3.94	No	N/A	13.64	0.00	13.64	0.289	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.31	19.25	3.49	No	N/A	13.64	0.00	13.64	0.256	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.52	19.25	3.04	No	N/A	13.64	0.00	13.64	0.223	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.74	19.25	2.59	No	N/A	13.64	0.00	13.64	0.190	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.96	19.25	2.14	No	N/A	13.64	0.00	13.64	0.157	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.18	19.25	1.69	No	N/A	13.64	0.00	13.64	0.124	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.40	19.25	1.24	No	N/A	13.64	0.00	13.64	0.091	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.62	19.25	0.79	No	N/A	13.64	0.00	13.64	0.058	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.84	19.25	0.34	No	N/A	13.64	0.00	13.64	0.025	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.05	19.25	-0.11	No	N/A	13.64	0.00	13.64	0.008	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.27	19.25	-0.56	No	N/A	13.64	0.00	13.64	0.041	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.49	19.25	-1.01	No	N/A	13.64	0.00	13.64	0.074	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.71	19.25	-1.46	No	N/A	13.64	0.00	13.64	0.107	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.93	19.25	-1.91	No	N/A	13.64	0.00	13.64	0.140	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.15	19.25	-2.36	No	N/A	13.64	0.00	13.64	0.173	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.37	19.25	-2.81	No	N/A	13.64	0.00	13.64	0.206	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.58	19.25	-3.26	No	N/A	13.64	0.00	13.64	0.239	Eqn (c)	Ties Not Req'd

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.02.18 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: (E) Kindergarten Floor Beams

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60L	1	11.80	19.25	-3.71	No	N/A	13.64	0.00	13.64	0.272	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	12.02	19.25	-4.16	No	N/A	13.64	0.00	13.64	0.305	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	12.24	19.25	-4.61	No	N/A	13.64	0.00	13.64	0.338	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	12.46	19.25	-5.06	No	N/A	13.64	0.00	13.64	0.371	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	12.68	19.25	-5.51	No	N/A	13.64	0.00	13.64	0.404	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	12.90	19.25	-5.96	No	N/A	13.64	0.00	13.64	0.437	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	13.11	19.25	-6.41	No	N/A	13.64	0.00	13.64	0.470	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	13.33	19.25	-6.86	No	N/A	13.64	0.00	13.64	0.503	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	13.55	19.25	-7.31	No	N/A	13.64	0.00	13.64	0.536	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	13.77	19.25	-7.76	No	N/A	13.64	0.00	13.64	0.569	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	13.99	19.25	-8.21	No	N/A	13.64	0.00	13.64	0.602	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	14.21	19.25	-8.66	No	N/A	13.64	0.00	13.64	0.635	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	14.43	19.25	-9.11	No	N/A	13.64	0.00	13.64	0.668	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	14.64	19.25	-9.56	Yes	9.63	18.98	11.88	30.86	0.310	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	14.86	19.25	-10.01	Yes	9.63	18.98	11.88	30.86	0.325	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	15.08	19.25	-10.46	Yes	9.63	18.98	11.88	30.86	0.339	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	15.30	19.25	-10.91	Yes	9.63	18.98	11.88	30.86	0.354	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	15.52	19.25	-11.36	Yes	9.63	18.98	11.88	30.86	0.368	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	15.74	19.25	-11.82	Yes	9.63	18.98	11.88	30.86	0.383	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	15.96	19.25	-12.27	Yes	9.63	18.98	11.88	30.86	0.397	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	16.17	19.25	-12.72	Yes	9.63	18.98	11.88	30.86	0.412	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	16.39	19.25	-13.17	Yes	9.63	18.98	11.88	30.86	0.427	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	16.61	19.25	-13.62	Yes	9.63	18.98	11.88	30.86	0.441	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	16.83	19.25	-14.07	Yes	9.63	18.98	11.88	30.86	0.456	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	17.05	19.25	-14.52	Yes	9.63	18.98	11.88	30.86	0.470	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	17.27	19.25	-14.97	Yes	9.63	18.98	11.88	30.86	0.485	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	17.49	19.25	-15.42	Yes	9.63	18.98	11.88	30.86	0.500	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	17.70	19.25	-15.87	Yes	9.63	18.98	11.88	30.86	0.514	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	17.92	19.25	-16.32	Yes	9.63	18.98	11.88	30.86	0.529	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	18.14	19.25	-16.77	Yes	9.63	18.98	11.88	30.86	0.543	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	18.36	19.25	-17.22	Yes	9.63	18.98	11.88	30.86	0.558	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	18.58	19.25	-17.67	Yes	9.63	18.98	11.88	30.86	0.572	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	18.80	19.25	-18.12	Yes	9.63	18.98	11.88	30.86	0.587	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	19.02	19.25	-18.57	Yes	9.63	18.98	11.88	30.86	0.602	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	19.23	19.25	-19.02	Yes	9.63	18.98	11.88	30.86	0.616	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	19.45	19.25	-19.47	Yes	9.63	18.98	11.88	30.86	0.631	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	19.67	19.25	-19.92	Yes	9.63	18.98	11.88	30.86	0.645	Eqn (a)	Max spacing per 9.7.6.2
+1.20D+1.60L	1	19.89	19.25	-20.37	Yes	9.63	18.98	11.88	30.86	0.660	Eqn (a)	Max spacing per 9.7.6.2

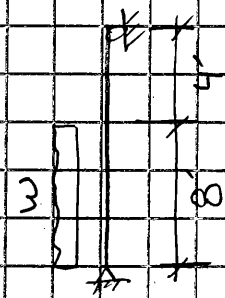
Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	20.000	102.96	114.26	0.90
+1.40D					
Span # 1	1	20.000	33.04	114.26	0.29
+1.20D+1.60L					
Span # 1	1	20.000	102.96	114.26	0.90
+1.20D+L					
Span # 1	1	20.000	74.97	114.26	0.66
+1.20D					
Span # 1	1	20.000	28.32	114.26	0.25
+0.90D					
Span # 1	1	20.000	21.24	114.26	0.19

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
1	+D+L	0.3174	10.000		0.0000	0.000

DESIGN STRONG-BACK TO BRACE WALL/COL AT BATHROOM



$F_p = 0.4\, S_{DS}\, K_a\, I_e\, W_p = 107$ PSF

USE $K_a = 2.0$
$I_e = 1.25$
$W_p = 80$ psf
$S_{DS} = 1.34$

$W_E = 2.7'(107\ \text{PSF}) = 289$ PLF

FOR $\Delta_{O.T.E} < \frac{L}{240}$, USE HSS 4x4x 3/16 MIN

$CC = 0.31 < 1$, $\Delta_{O.T.E} = \frac{L}{362} < \frac{L}{360}$, OK.

- SEE ATTACHED.

TO MATCH STRENGTH OF (E) 6" PIPE STD
NEED $Z_{HSS} = 10.6\ in^3 \left(\frac{35\ ksi}{50\ ksi}\right) = 7.4\ in^3$

USE HSS 6x6x 3/16 MIN
$Z = 8.6\ in^3$

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Strongback

Code References

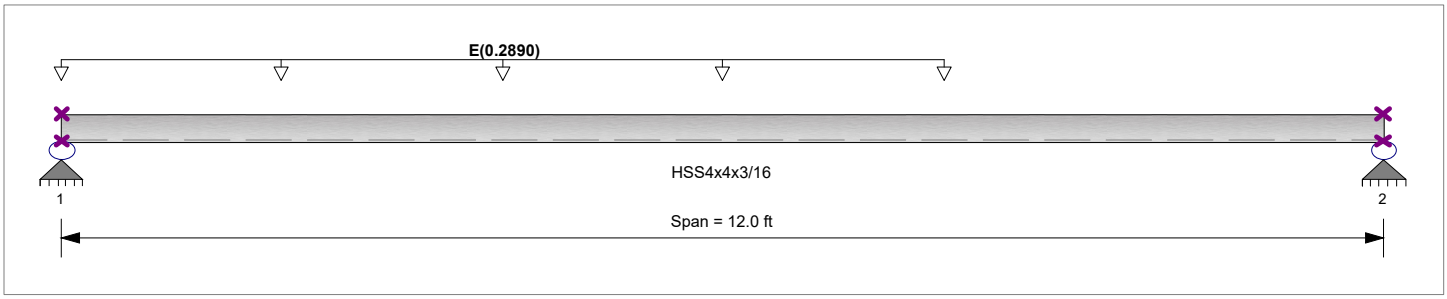
Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Rho (or Omega) = 1.00

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load for Span Number 1
Partial Length Uniform Load : E = 0.2890 k/ft, Extent = 0.0 -->> 8.0 ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.314 : 1	Maximum Shear Stress Ratio =	0.050 : 1
Section used for this span	HSS4x4x3/16	Section used for this span	HSS4x4x3/16
Ma : Applied	2.877 k-ft	Va : Applied	1.079 k
Mn / Ω : Allowable	9.157 k-ft	Vn / Ω : Allowable	21.743 k
Load Combination	+0.70E	Load Combination	+0.70E
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.397 in	Ratio =	362 >=360.	Span: 1 : +0.70E
Max Upward Transient Deflection	0 in	Ratio =	0 <360.0	n/a
Max Downward Total Deflection	0 in	Ratio =	0 <240.0	n/a
Max Upward Total Deflection	0 in	Ratio =	0 <240.0	n/a

Maximum Flexural Forces & Stresses for Load Combinations

Load Combination / Segment	Unbraced Length UL Length ft	Span #	Cb	Max Flexural Stress Ratio	+ve Moment +ve M SR	Mmax +	Mnx/Ω+	-ve Moment -ve M SR	Mmax -	Mnx/Ω-
Design Segment 1 L=12.00 +0.70E	1 12.00	1	1.00							
Design Segment 1 L=12.00 +0.5250E	1 12.00	1	1.18	0.314	0.314	2.88	9.16			
Design Segment 1 L=12.00	1 12.00	1	1.18	0.236	0.236	2.16	9.16			

Maximum Shear Forces & Stresses for Load Combinations

Load Combination	V SR	Vmax	Vnx	Vnx/Ω
Design Segment 1 L=12.00 +0.70E	0.000	-0.00	36.31	21.74
Design Segment 1 L=12.00 +0.5250E	0.050	1.08	36.31	21.74
Design Segment 1 L=12.00	0.037	0.81	36.31	21.74

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+0.70E	0.3973	5.794		0.0000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Libby Booth.ec6

LIC# : KW-06015779, Build:20.26.07.01 Will Engineering LLC (c) ENERCALC, LLC 1982-2026

DESCRIPTION: Strongback

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Cases & Combinations	1.541	0.771
Max Upward from Load Combinations	1.079	0.539
Max Upward from Load Cases	1.541	0.771
+0.70E	1.079	0.539
+0.5250E	0.809	0.405
E Only	1.541	0.771

Vertical Reactions for Load Cases

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from Load Cases	1.541	0.771
E Only	1.541	0.771

Vertical Reactions for Load Combinations

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from Load Combinations	1.079	0.539
+0.70E	1.079	0.539
+0.5250E	0.809	0.405

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT

FACILITY AND MATERIAL LOCATION: Libby Booth Elementary School **MDP #26-173**

DESCRIPTION OF WORK TO BE PERFORMED: Interior Remodel and New STEAM/Media Center Building

IT IS THE RESPONSIBILITY OF THE CONTRACTOR/WORKER TO IDENTIFY MATERIAL TYPE PRIOR TO DISTURBANCE. ONLY MATERIALS LISTED ON THIS PERMIT MAY BE DISTURBED. ANY NEW MATERIAL DISCOVERED OR ANY MATERIAL WHOSE EXACT NATURE OR CHARACTER IS UNCERTAIN REQUIRES A NEW PERMIT PRIOR TO DISTURBANCE. ANY CITATIONS OR ASBESTOS/LEAD CONTAMINATION RESULTING FROM THE IMPROPER OR UNAUTHORIZED DISTURBANCE OF ASBESTOS OR LEAD MATERIALS IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR. A COPY OF THIS PERMIT MUST BE SIGNED BY THE CONTRACTOR AND SUBMITTED TO THE DISTRICT PRIOR TO STARTING THE PROJECT.

REFER TO THE MAP ON THE LAST PAGE OF THIS PERMIT FOR ADDITIONAL INFORMATION ON BLDG/ROOF AREA ALPHABETICAL IDENTIFICATION LETTERS BEING REFERRED TO IN THIS PERMIT. DO NOT USE ANY OTHER SOURCE TO DETERMINE WHAT AREAS ARE IDENTIFIED IN THIS PERMIT. THE BUILDING/ROOF IDENTIFICATION LETTERS USED IN THIS PERMIT MAY NOT NECESSARILY MATCH WHAT IS FOUND OR REFERENCED IN THE FIELD OR IN OTHER CONTRACT DOCUMENTS.

ITEM #1	MATERIAL DESCRIPTION: **GYPSUM BOARD BUILDING SYSTEM**
AHERA MATERIAL NUMBER: M-01	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB.	

ITEM #2	MATERIAL DESCRIPTION: **BLOCK/MORTAR**
AHERA MATERIAL NUMBER: M-02B	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: THE BLOCK/MORTAR HAS BEEN SAMPLED IN ACCORDANCE WITH AHERA AND ASTM PROTOCOLS AND DOES NOT CONTAIN ASBESTOS. OK TO DISTURB. COMPLETE SURVEY RESULTS AVAILABLE UPON REQUEST.	

ITEM #3	MATERIAL DESCRIPTION: **CONCRETE**
AHERA MATERIAL NUMBER: M-02C	CONTAINS ASBESTOS ?: **NO/UNKNOWN**
MATERIAL DISTURBANCE INSTRUCTIONS: CONCRETE SLATED FOR REMOVAL OR DISTURBANCE ON THIS PROJECTS DRAWINGS HAS BEEN SAMPLED AND IT DOES NOT CONTAIN ASBESTOS. IF ANY OTHER CONCRETE THAT IS NOT IDENTIFIED ON THE DRAWINGS MUST BE DISTURBED, THE CONTRACTOR MUST TREAT THIS CONCRETE AS ASBESTOS CONTAINING, AND IN ACCORDANCE WITH ALL APPLICABLE ASBESTOS REGULATIONS AND REQUIREMENTS UNTIL THIS MATERIAL HAS BEEN PROPERLY SAMPLED BY THE ES&A DEPARTMENT AND DETERMINED IT DOES NOT CONTAIN ASBESTOS. ALL CONCRETE CONTAINS SILICA SO IF THE CONTRACTOR MUST CUT, ABRADE, OR GRIND THIS MATERIAL; THE CONTRACTOR MUST ALSO COMPLY WITH THE FEDERAL SILICA REGULATION AND ITS REQUIREMENTS REGARDLESS OF ASBESTOS CONTENT.	

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
CONTINUATION PAGE – SCHOOL #106

ITEM #4	MATERIAL DESCRIPTION: **METAL BUILDING MATERIALS**
AHERA MATERIAL NUMBER: M-03	CONTAINS ASBESTOS ?: NO
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB.	

ITEM #5	MATERIAL DESCRIPTION: **TRANSITE/CEMENTITIOUS PANELS**
AHERA MATERIAL NUMBER: M-04P	CONTAINS ASBESTOS ?: **YES**
MATERIAL DISTURBANCE INSTRUCTIONS: CONTAINS ASBESTOS	

ITEM #6	MATERIAL DESCRIPTION: **TRANSITE PIPE**
AHERA MATERIAL NUMBER: M-04P	CONTAINS ASBESTOS ?: **YES**
MATERIAL DISTURBANCE INSTRUCTIONS: CONTRACTOR IS RESPONSIBLE FOR THE DISTURBANCE AND REMOVAL OF DAMAGED TRANSITE PIPE AS REQUIRED TO PERFORM REPAIR/INSTALLATION PROPERLY. CONTRACTOR WILL ONLY UTILIZE WORKERS WITH A MINIMUM OF 16 HOURS OF ASBESTOS TRAINING. AND ABSOLUTELY NO CUTTING OF THE PIPE IS AUTHORIZED. ONLY SNAP CUTTING CAN BE CONDUCTED AND THE CONTRACTOR MUST COMPLY WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS. THE PIPE MUST BE DISPOSED OF PROPERLY TO INCLUDE IMMEDIATE WRAPPING WITH TWO LAYERS OF 6 MIL POLY ON THE SITE UPON REMOVAL. ANY DISTURBANCE MUST BE NOTIFIED TO ES&A AT 325-8490 IMMEDIATELY PRIOR TO DISTURBANCE.	

ITEM #7	MATERIAL DESCRIPTION: **WOOD BUILDING PRODUCTS**
AHERA MATERIAL NUMBER: M-06	CONTAINS ASBESTOS ?: NO
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB.	

ITEM #8	MATERIAL DESCRIPTION: **WOOD/METAL DOOR**
AHERA MATERIAL NUMBER: M-08	CONTAINS ASBESTOS ?: YES - ASSUMED
MATERIAL DISTURBANCE INSTRUCTIONS: DOORS ARE TO BE SAMLED DURING CONSTRUCTION IF REQUIRED.	

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
CONTINUATION PAGE – SCHOOL #106

ITEM #9	MATERIAL DESCRIPTION: **CEILING TILE – ACT - FCP**
AHERA MATERIAL NUMBER: M-10	CONTAINS ASBESTOS ?: NO
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB. NOTE THERE ARE TRANSITE CEILING PANEL LOCATED IN THE D-WING THAT CONTAIN ASBESTOS. THE NON ASBESTOS CEILING TILES ARE NOT MADE OF TRANSITE WHICH IS A MATERIAL MADE OF CONCRETE AND ASBESTOS MATERIAL.	

ITEM #10	MATERIAL DESCRIPTION: **FLOOR TILE AND MASTIC – VSF - VFT**
AHERA MATERIAL NUMBER: M-12	CONTAINS ASBESTOS ?: NO
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB.	

ITEM #11	MATERIAL DESCRIPTION: **BASE COVE AND MASTIC**
AHERA MATERIAL NUMBER: M-13	CONTAINS ASBESTOS ?: NO
MATERIAL DISTURBANCE INSTRUCTIONS: THIS MATERIAL DOES NOT CONTAIN ASBESTOS BUT THE PAINTS AND COATING ON THE WALLS DOES CONTAIN LEAD. IF THIS BASE COVE MUST BE REMOVED, AS A PART OF A FLOORING PROJECT, THE CONTRACTOR MUST COMPLY WITH DISTRICT SUPPLED BASE COVE LEAD REMOVAL SPECIFICATIONS PROVIDED BY THE DISTRICT'S HIRED LEAD CONSULTANT. IN ADDITION, THE DISTRICT HIRED LEAD CONSULTANT WILL BE REQUIRED TO WATCH THE BASE COVE REMOVAL. THE CONTRACTOR MUST SCHEDULE ALL DISTURBANCES WITH THE DISTRICT'S LEAD CONSULTANT AND NO DISTURBANCE CAN BE CONDUCTED WHEN THEY ARE NOT THERE.	

ITEM #12	MATERIAL DESCRIPTION: **SHEET VINYL AND MASTIC**
AHERA MATERIAL NUMBER: M-14	CONTAINS ASBESTOS ?: NO
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB.	

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
CONTINUATION PAGE – SCHOOL #106

ITEM #13	MATERIAL DESCRIPTION: **CARPET AND MASTIC – INCLUDES WALK OFF**
AHERA MATERIAL NUMBER: M-15	CONTAINS ASBESTOS ?: NO
MATERIAL DISTURBANCE INSTRUCTIONS: VERIFY THAT NO FLOOR TILE IS PRESENT UNDER CARPET. OK TO DISTURB IF NO TILE IS PRESENT. IF TILE IS PRESENT REFER AND COMPLY WITH ALL MATERIAL INSTRUCTION IDENTIFIED FOR MATERIAL #M-12, FLOOR TILE AND MASTIC. NO REMOVAL OF CARPET GLUED TO FLOOR TILES IS AUTHORIZED.	

ITEM #14	MATERIAL DESCRIPTION: **FIBERGLASS BUILDING INSULATION**
AHERA MATERIAL NUMBER: M-17	CONTAINS ASBESTOS ?: NO
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB.	

ITEM #15	MATERIAL DESCRIPTION: **ASBESTOS PIPE INSULATION**
AHERA MATERIAL NUMBER: T-40	CONTAINS ASBESTOS ?: **ABATED BUT SEE BELOW**
MATERIAL DISTURBANCE INSTRUCTIONS: ALL EXPOSED AND ACCESSIBLE ASBESTOS PIPE INSULATION HAS BEEN ABATED. THERE MAY BE ASBESTOS PIPE INSULATION THAT WAS INACCESSIBLE DURING THE ASBESTOS ABATEMENT ACTIVITIES THAT INTENDED TO ABATE ALL PIPE INSULATION IN THIS FACILITY. CARE MUST BE TAKEN AND IF ANY HARD PIPE INSULATION IS ENCOUNTERED, ANY SUSPECT PIPE INSULATION THAT IS NOT VERIFIED FIBERGLASS MUST BE TREATED AS ASBESTOS CONTAINING OR SAMPLED AND VERIFIED AS NON-ASBESTOS CONTAINING BEFORE ANY DISTURBANCE TAKES PLACE.	

ITEM #16	MATERIAL DESCRIPTION: **FIBERGLASS PIPE INSULATION**
AHERA MATERIAL NUMBER: T-41	CONTAINS ASBESTOS ?: NO
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB HOWEVER IF HARD ELBOWS ARE ENCOUNTERED THESE CANNOT BE DISTURBED. HARD ELBOWS CONTAIN ASBESTOS.	

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
CONTINUATION PAGE – SCHOOL #106

ITEM #17	MATERIAL DESCRIPTION: **PLUMBING/MECHANICAL GASKETS**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **YES**
MATERIAL DISTURBANCE INSTRUCTIONS: PLUMBING AND MECHANICAL GASKETS HAVE BEEN FOUND TO CONTAIN ASBESTOS IN THE DISTRICT. THE CONTRACTOR MUST ASSUME ANY GASKET THAT NEEDS TO BE REMOVED OR DISTURBED CONTAINS ASBESTOS AND THE CONTRACTOR IS RESPONSIBLE TO HIRE AN ASBESTOS CONTRACTOR THAT WILL BE SUPERVISED BY THE DISTRICT TO PROPERLY REMOVE (AS PER DISTRICT ASBESTOS ABATEMENT SPECIFICATIONS AND/OR DISTRICT HIRED ASBESTOS CONSULTANT SPECIFICATIONS) OR CUT OUT THOSE GASKETS AND DISPOSE OF AS ASBESTOS CONTAINING MATERIALS. THE CONTRACTOR IS RESPONSIBLE FOR VISITING THE SITE AND DETERMINING IF ANY GASKETS NEED REMOVAL OR WILL BE DISTURBED PRIOR TO BIDDING AND THIS COST IS TO BE ADDED TO THE PRICE PROVIDED TO THE DISTRICT BY THE CONTRACTOR TO COMPLETE THE ABOVE DESIGNATED PROJECT. ABATEMENT MUST BE COMPLETED WHEN SCHOOL IS UNOCCUPIED. DELAYS DUE TO ABATEMENT ISSUES OR SCHEDULES MAY BE ENCOUNTERED. NOTIFY THE WCSD ES&A DEPARTMENT AND ANY DISTRICT HIRED ASBESTOS CONSULTANT TO SCHEDULE ANY REQUIRED ABATEMENT AT LEAST TWO WEEKS IN ADVANCE PRIOR TO REMOVAL.	

ITEM #18	MATERIAL DESCRIPTION: **TACKABLE SURFACES - TACK BOARD**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB.	

ITEM #19	MATERIAL DESCRIPTION: **HVAC FIRE DAMPERS**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **YES – ASSUMED**
MATERIAL DISTURBANCE INSTRUCTIONS: HVAC FIRE DAMPERS ARE TO BE SAMLED DURING CONSTRUCTION IF REQUIRED.	

ITEM #20	MATERIAL DESCRIPTION: **SINK COATING (BLACK)**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB	

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
CONTINUATION PAGE – SCHOOL #106

ITEM #21	MATERIAL DESCRIPTION: **DOOR FRAME/WINDOW/RESTROOM SEALANT**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB	

ITEM #22	MATERIAL DESCRIPTION: **FRP**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB	

ITEM #23	MATERIAL DESCRIPTION: **DUCT MASTIC**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB	

ITEM #24	MATERIAL DESCRIPTION: **FOAM INSULATION**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB	

ITEM #25	MATERIAL DESCRIPTION: **EPOXY**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB	

ITEM #26	MATERIAL DESCRIPTION: **BULLETIN BOARD PANELS**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **NO**
MATERIAL DISTURBANCE INSTRUCTIONS: OK TO DISTURB	

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
CONTINUATION PAGE – SCHOOL #106

ITEM #27	MATERIAL DESCRIPTION: **ROOFING MATERIALS**
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: **YES/NO**

MATERIAL DISTURBANCE INSTRUCTIONS: THE ROOFING MATERIALS AT THIS SCHOOL HAVE BEEN SURVEYED BY HMS. THE HMS SURVEY DATED 1/3/11 SHOWS THE FOLLOWING:

ASBESTOS ROOF AREAS – (SEE ATTACHED MAP ON LAST PAGE)
ROOF AREA "D" HAS AN AREA WITH ASBESTOS CONTAINING BLACK MASTIC ON A BELL VENT THAT CONTAINS ASBESTOS; IF THIS MATERIAL HAS TO BE DISTURBED COMPLY WITH ALL ASBESTOS REQUIREMENTS LISTED BELOW.

NON-ASBESTOS ROOF AREAS– (SEE ATTACHED MAP ON LAST PAGE)
ROOF AREAS "A", "B", "C", "E", & "F", DO NOT CONTAIN ASBESTOS, OK TO DISTURB. THE CONTRACTOR CAN REQUEST A COPY OF THE DRAWING SHOWING THE AREAS IDENTIFIED WHICH HAS ADDITIONAL INFORMATION BY CONTACTING THE ES&A DEPARTMENT @ 325-8490.

ASBESTOS REQUIREMENTS
IF THE CONTRACTOR MUST DISTURB THE ASBESTOS CONTAINING AREAS IDENTIFIED ABOVE, THE CONTRACTOR IS RESPONSIBLE FOR PROPERLY COMPLETING THE WORK AND THE CONTRACTOR WILL INSURE THAT ALL PERSONNEL PERFORMING REMOVAL OR DISTURBANCES ARE PROPERLY ASBESTOS TRAINED AND PERSONAL AIR MONITORING MUST BE CONDUCTED THROUGHOUT ANY DISTURBANCE OR REMOVAL. AIR SAMPLING RESULTS MUST BE PROVIDED TO THE ES&A DEPARTMENT, DIRECTLY FAXED OR E-MAILED FROM THE LABORATORY WITHIN 48 HOURS AFTER DISTURBANCE OR REMOVAL. IN ADDITION, A HEPA VACUUM MUST BE ON SITE AND USED TO CLEAN UP ALL DEBRIS. THE REQUIREMENTS LISTED ABOVE, ARE THE DISTRICTS MINIMUM DISTURBANCE REQUIREMENTS. IF REMOVAL OF ROOFING MATERIALS, RATHER THEN DISTURBANCES IS REQUIRED, THE CONTRACTOR MUST COMPLY WITH A MORE INVOLVED SET OF DISTRICT PROCEDURES/SPECS AND THAT PROCEDURE/SPEC IS AVAILABLE UPON REQUEST BY CONTACTING THE ES&A DEPARTMENT AT 325-8490. IN ADDITION, THERE ARE OSHA TRAINING REQUIREMENTS, SPECIFIC TO ROOFING MATERIALS, AND THE CONTRACTOR IS REQUIRED TO COMPLY WITH OSHA AS WELL AS ANY ADDITIONAL REGULATORY REQUIREMENT NOT LISTED.

NOTE: THE ASBESTOS MATERIAL DISTURBANCE INSTRUCTIONS LISTED ABOVE ARE BASED ON THE AHERA REGULATION. THERE MAY EXIST OTHER REGULATIONS THAT MAY BE MORE STRINGENT THEN THESE RECOMMENDATIONS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE COMPLIANCE WITH ALL REGULATIONS THAT ARE APPLICABLE TO THE DISTURBANCE OF ASBESTOS/LEAD CONTAINING MATERIALS. ASBESTOS IS A MICROSCOPIC FIBER AND THE CLEANING OF ASBESTOS DEBRIS MUST BE CONDUCTED TO A MICROSCOPIC LEVEL. IN THE EVENT THAT ANY VISIBLE DEBRIS IS DISCOVERED FROM A DISTURBANCE OR AIR SAMPLING RESULTS ARE NOT PROVIDED TO THE DISTRICT, THE DISTRICT WILL IMMEDIATELY HIRE A THIRD PARTY LEAD/ASBESTOS CONSULTANT TO INVESTIGATE POSSIBLE LEAD/ASBESTOS CONTAMINATION AND AN LEAD/ASBESTOS ABATEMENT CONTRACTOR TO PERFORM ANY RECOMMENDED CLEAN-UP. THE CONTRACTOR WILL BE REQUIRED TO REIMBURSE THE DISTRICT FOR ALL COSTS INCURRED. IF AIR MONITORING IS REQUIRED, AIR MONITORING MUST BE CONDUCTED THROUGHOUT THE PROJECT. AIR MONITORING RESULTS FAXED DIRECTLY FROM THE LAB TO THE ES&A DEPARTMENT @ 851-5695, WITHIN 48 HOURS OF THE DISTURBANCE

DATE ISSUED: September 10, 2026

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
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Material Water & Lead Disturbance Permit, Water System Disturbance Permit Appendix Page #1

Contractors, their sub-contractors or workers are responsible in completing all work without impacting the water quality of District facilities and the domestic water supplies which feed district facilities. This Water System Disturbance Permit identifies the minimum requirements that Contractors, their sub-contractors and all workers will utilize to perform disturbance to the Districts water systems.

The following general requirements shall apply to any person who will be disturbing a District water system. In addition, they must contact the Environmental, Safety and Assessment Department (ES&A Dept) prior to any disturbance at 325-8494. This phone number has an answering machine and can be accessed 24 hours a day. These disturbances will be logged in and documented by the ES&A department.

All requirements for isolation are designed to protect the facility's potable water source from existing as well as potential cross-connections and to prevent any backflow occurrences in the form of backpressure or backsiphonage. The Water Disturbance Procedures listed are not site or incident specific and great care must be taken by technicians during all valving and isolation activities within a facility to prevent a potential backflow occurrence. There may be additional requirements that must be utilized to prevent any cross-connection or backflow occurrence, and each entity performing the disturbance is responsible for ensuring none occur and utilizing any additional steps as necessary to ensure none result from the completion of this project.

Any costs to correct any cross-connections and/or any backflow occurrences that result from the performance of this project are solely the responsibility of the Contractor, their sub-contractor and workers and the signing of this ES&A Department Disturbance Permit on acknowledges and agrees to this requirement.

FACILITY ISOLATION MINIMUM REQUIREMENTS

MECHANICAL ROOMS:

When turning off or disrupting the water service to a mechanical room all applicable requirements below must be conducted per this permit

1. **Remove all hoses from custodial faucets and bibs in location to be effected.**
2. **Shut down all boiler and chiller circulating pumps. Heating, Cooling and Domestic.**
3. **Shut down boiler, chiller and cooling tower if present.**
4. **Isolate boiler, cooling tower, chiller and relieve pressure from boiler.**
5. **Shut down hot water return pump, isolate any hot water heaters and turn off heating source.**
6. **Isolate domestic service to mechanical room.**
7. **Re-establish service to mechanical room in reverse order.**

BASIC WING:

When turning off or disrupting the water service to a facility wing all applicable requirements below must be conducted per this permit

1. **Remove all hoses from custodial, art and science faucets along with bibs in location to be effected.**
2. **Isolate all water utilizing chemical dispensers in location to be effected.**
3. **Shut down and isolate any water using equipment if applicable. Hot water heaters, domestic make ups for heat exchangers, photo labs, etc.**
4. **Isolate domestic cold water main to wing.**
5. **Re-establish service to wing in reverse order. Flush system at the end of each lateral to remove any and all foreign material and air.**

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FACILITY:

When turning off or disrupting the water service to a facility all applicable requirements below must be conducted per this permit. Turning off or disturbing the waters services to a facility should only be done as a last resort. If it is possible to isolate the area of disturbance without disrupting facilities entire water service that is the way the project is to be accomplished. This will also keep the contractor, his sub-contractors or workers from having to perform all the listed requirements.

1. **Remove all hoses from custodial, art and science faucets along with bibs in entire facility.**
2. **Isolate mechanical room. See above requirements.**
3. **Isolate each individual wing where possible. See above requirements.**
4. **Isolate all irrigation laterals connected to the domestic potable water supply.**
5. **Isolate domestic cold water main at all locations present to allow as little drain back as possible.**
6. **Re-establish service to facility in reverse order. Flush system at the end of each lateral to remove any foreign material and air.**

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
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PAINTS AND COATINGS – Material Disturbance Permit Appendix - Lead in Paints and Coatings in WCSD Facilities

Lead containing paints and coating are present in WCSD facilities. Bidders/Contractors that disturb lead containing or potentially lead containing paints or coatings, by law, are required to know all applicable regulations applicable and comply with all state and federal regulations that apply to the disturbances to lead paints and coating they are conducting. The regulations that requires by a contractor to be properly trained and knowledgeable, related to lead disturbance includes, but is not limited to the following:

- **OSHA Regulation CFR 1926.62 – Lead & Appendix A, B, C, & D – Lead Construction Standard.**
- **OSHA Regulation CFR 1910. 1025 - Lead & Appendix A, B, C, & D – General Industry Standard.**
- **EPA, 40 CFR Part 745 – Lead; Renovation, Repair, and Painting Regulation.**

Bidders/Contractors accept and acknowledge by signing this Material Disturbance Permit, the existence of lead related regulations, and accept all liability related to the disturbance of lead containing materials, citation resulting from, or any other costs the District may incur by the action of all parties of the bidders company or companies hired by the successful bidder to complete this project.

CONSTRUCTION AGE OF BUILDINGS AT THIS FACILITY

Lead sampling has shown that lead containing paints, coatings and ceramic tiles DO routinely exist, even in our newest facilities even constructed after 1978. Since age does not determine the presence of lead, Contractors need the date a facility was constructed to determine if the RR&P rule applies. To that end, we are providing construction date information for RR&P applicability. There are 2 lead category's tables addressed in this lead portion of the permit: The category 1 table addresses buildings built before 1978 and Category 2 table addresses buildings built after 1978

LEAD CATEGORY #1	**PAINTS, COATINGS & CERAMIC TILE IN BUILDINGS CONSTRUCTED BEFORE 1978**
CONTAINS LEAD?:**YES/NO – for NO see Appendix 1**	**Buildings: "A", "B", "C", & "D"**

Lead Containing or Assumed Lead Containing Paints and Coatings Disturbance Instructions

If project lead specific paints and coating sampling has been requested by the District Project Manager, and completed by the ES&A department for this project, the results of that lead sampling are attached at the end of this permit. It is titled: **Project Specific Lead Sampling Results – Appendix #1.** The Contractor **must** treat all paints and coating as lead containing in the buildings except any exclusions on Appendix #1 and comply with all lead requirements. Contractor must plan and bid accordingly.

OSHA Requirements

All persons performing any disturbance to coatings or paints to paints and coating in and on the buildings listed above must have taken an OSHA lead action level training class from a WCSD, ES&A department approved training provider, and utilize lead safe work practices. In addition, all work must be completed, as a minimum, utilizing the lead safe work practices identified in the EPA guidance document titled "steps to lead safe renovation, repair and painting", pages 12 thru 23. This document is available electronically at the following link: HTTP://WWW.EPA.GOV/LEAD/PUBS/STEPS.PDF.

EPA Renovation, Repair and Painting Regulation Requirements

In general, all firms that disturb 6 square feet of painted surface in a room or 20 square feet on the exterior within a 30 day period in **this** facility must comply with the EPA's Renovation, Remodel and Repair (RR&P) regulation and must be registered with the federal EPA. Per the Regulation, the area of disturbance is calculated, by adding up the entire surface areas being removed/disturbed, which then determines the amount of painted surface area disturbed. Work that involves window replacement or demolition of a painted surface, the RR&P regulation applies regardless of size. This regulation also requires that the contractor must assign a RR&P trained supervisor that is responsible for ensuring and documenting all work is conducted in compliance with the RR&P regulation and there are extensive record keeping and notification requirements that the Contractor must perform. In addition, This is a general overview of the regulation and the contractor must refer to regulation for additional requirements and information. Fines are expensive and the compliance with this regulation rests solely on the Contractor so it is very important that Bidders/Contractors are well versed in this regulation.

– CONTINUED SEE NEXT PAGE #9

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MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
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LEAD CATEGORY #1	PAINTS, COATINGS & CERAMIC TILE IN BUILDINGS CONSTRUCTED BEFORE 1978
CONTAINS LEAD?:**YES/NO – for NO see Appendix 1**	**Buildings: "A", "B", "C", & "D"**

– CONTINUED FROM PAGE #8

WCSD Requirements

In addition to regulatory requirements, the WCSD has requirements that must be met by the Contractor/Bidder. The contractor is responsible for submitting to the ES&A department lead disturbance procedures that outline the lead safe work practices to be utilized and that procedure must comply with the Districts minimum lead disturbance requirements. The current minimum lead disturbance requirements, which will apply to this project, follow these tables.

OSHA action level training and RR&P training certification and RR&P firm certification must be submitted to the project manager and they are to submit a copy to the ES&A department. The ES&A department must review, verify, and approve all required documentation **prior** to the contractor being able to perform any disturbance, so time for review must be taken into account when developing schedules. Once the ES&A department has approved the procedures and training and firm certification, the contractor may proceed but they must notify the ES&A department at 325-8490 of **any** paint/coating disturbance immediately disturbance prior to the disturbance**.** ES&A department personnel, project managers and assistant project managers and other district personnel will spot check in the field, to ensure compliance with the contractors submitted and approved procedures.

Refer to section listed below regarding lead sampling that may be available.

LEAD CATEGORY #2	PAINTS, COATINGS & CERAMIC TILE IN BUILDINGS CONSTRUCTED AFTER 1978
CONTAINS LEAD?:**YES/NO – for NO see Appendix 1**	**Buildings: "E", & "F".**

Lead Containing or Assumed Lead Containing Paints and Coatings Disturbance Instructions

If project lead specific paints and coating sampling has been requested by the District Project Manager, and completed by the ES&A department for this project, the results of that lead sampling are attached at the end of this permit. It is titled: **Project Specific Lead Sampling Results – Appendix #1.** The Contractor **must** treat all paints and coating as lead containing in the buildings except any exclusions on Appendix #1 and comply with all lead requirements. Contractor must plan and bid accordingly.

RR&P Regulation - The building(s) listed above in Lead Category #2 were/was constructed after 1978, so the EPA RR&P regulation does not apply to these buildings.

Material Disturbance instructions: The buildings listed above was/were constructed after 1978 and lead sampling has verified that the paints and coating at this facility, other than exclusions listed above, do indeed contain lead. The Contractor **must** comply with all Lead Containing or Assumed Lead Containing Paints and Coatings Disturbance Instructions requirements listed in Lead Category 1 (if present) above or as listed below. No additional sampling is to be done by the district or the Contractor. Contractor must plan and bid accordingly.

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A NOTE ABOUT SAMPLING AND SAMPLING REQUEST PROCEDURES

Only approximately 20% of the paints and coatings in the District have been found to contain lead. The majority of white and off-white paints on sheetrock and block walls does not contain lead in facilities constructed after approx. 1990. Brighter or more colorful paints/coatings on any surface, or all paints and coatings on metals, are much more likely to be found to contain lead in all facilities. In addition, ceramic tile in any age facility is very likely to contain lead. It is highly recommended that sampling be done to confirm lead content unless time does not allow a delay for processing samples through the WCSD ES&A department. If paints and coatings are not sampled, all paints and coatings must be assumed to be lead containing, above 5000 parts per million (lead based), and treated in accordance with all lead regulations, lead specifications, and requirements identified in this permit.

The process to request lead sampling is for anyone requiring sampling to submit through their project's Project Manager. The designated WCSD Project Manager will submit the required sampling forms, and sampling will be coordinated by the ES&A department. A minimum of 10 days will be allowed before sampling results are provided to the Project Manager for them to be distributed to all interested parties. All lead sampling must be processed through the ES&A department, and sampled by ES&A approved and trained lead professionals.

If project lead specific paints and coatings sampling has been requested by the District Project Manager, and completed by the ES&A department, the results of that lead sampling will be attached at the end of this permit. It will be titled: Project Specific Lead Sampling Results – Appendix #1. If there is no Project Specific Lead Sampling Results – Appendix #1 attached that means no project specific lead sampling has been requested and the Contractor must utilize only the information provided in the lead instructions of this permit.

Any paints or coatings that are not specifically addressed on this permit, or on the project drawings, has to be assumed to be lead containing, and above 5000 parts per million (lead based) – no exceptions. Any disturbance to those paints and coatings not specifically addressed on this permit or on the project drawings must be done by properly trained (Minimum of OSHA action level training) personnel, and those disturbances must be performed in accordance with all lead requirements listed in this permit, as well as any applicable regulations and local requirements. Many times scope modifications are required after the bid, and new areas of the facility may need to be disturbed. These areas would not have been addressed on this permit, since they were unknown at the time of issuance. Additional sampling could be conducted by requesting lead sampling through their project's Project Manager, but there will be a delay getting sampling requests and a new MDP would be required. The District reserves the right to direct the Contractor to assume new paints and coatings, due to scope changes, are lead containing and the contractor would then be required to treat all paints and coatings as lead containing in compliance with all requirements of this permit.

REPLACEMENT PAINTS, COATINGS, CERAMIC TILE, AND OTHER LEAD CONTAINING MATERIALS

Unless otherwise specifically allowed by this projects specifications, the Contractor shall not reinstall any lead containing paints/coatings in any detectable levels during the process of completing this project. "lead containing" is defined as any paint or coating that has ANY detectable lead level when paint chip sampling is conducted and chip is analyzed by the ICP method. The District may perform sampling of replacement materials and if analysis finds any detectable levels of lead, the Contractor will be liable for all costs to properly remove that material and re-apply paints and coatings with no detectable levels of lead. Contractors are encouraged to pre-sample paints they may be using to determine the actual amount in paint/coatings used.

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MINIMUM REQUIREMENTS TO PERFORM ATTACHMENTS AND PENETRATIONS IN WCSD FACILITIES

Below are the minimum requirements to perform any Attachment and Penetration activity to a known or assumed asbestos and/or lead containing material in Washoe County School District (WCSD) facilities. This document is not provided to address demolition, stabilization, abatement, or removal activities. If any work to known or assumed asbestos or lead materials need to be done on this project, and it is anything other than the installation of screws, the removal of screws, or the drilling of holes, the successful bidder must comply with, in addition to these minimum requirements, all applicable District asbestos and lead specifications and requirements. Regarding these procedures, the District has done its best to provide a complete and regulatory compliant attachment and penetration procedure, but by signing this MDP, the Contractor acknowledges that it is the successful bidder's sole responsibly for compliance with this MDP, as well as any other applicable regulatory requirements.

ASBESTOS/LEAD PROCEDURE SUBMISSION PROCESS

Prior to starting this project, each contractor working on this project is required to submit to the WCSD ES&A department an asbestos/lead procedure that includes all District requirements listed below. To simplify the procedure submittal process, an electronic PDF fillable template of these requirements will be provided to the successful bidder of this project. This document is available by contacting the assigned WCSD Capital Projects Project Manager for this project. Contractors must utilize the most current above-mentioned electronic template and fill out all required information, add company letterhead, sign, and date the document. The completed procedures will be e-mailed to the Project Manager by all contractors working on this project that will performing any applicable disturbances. Once submitted, the WCSD Project Manager will pass the document onto the ES&A department for approval. Successful bidders are required to add time to their project schedule for this procedure submittal and approval process.

The Contractor has the option to submit a site-specific or blanket district-wide applicable procedure. A district-wide blanket procedure applies to a scheduled project, as well as all future sites where a contractor will be performing disturbances. The site specific procedure will apply to just one site or project. District-wide procedures are valid for one year from the date the procedure is signed by the ES&A department. Site specific procedures will be valid for the term of the project. Each Contractor must receive a signed and approved procedure prior to performing any disturbances to all asbestos/lead paint or assumed asbestos/lead paint materials. The procedure is a combined procedure and it addresses both asbestos and lead disturbances. A minimum of one work day will be required by the ES&A department for the review and approval process.

In addition to the Material Disturbance Permit (MDP), the Contractors must also have a copy of the approved procedures on site at all times. The purpose of this procedure is to document the agreement between the Contractor and the District that all lead and asbestos disturbances performed by staff of the Contractor will be done per all noted District requirements, District Specifications, and project specifications. Again, Contractors must ensure that their procedure has been approved, and the approved signed procedure is on site prior to any disturbance.

MINIMUM REQUIREMENTS

1. Receive approved Lead/Asbestos procedures as identified above.

2. Technicians performing disturbances will be required to have a minimum of AHERA 16 Hour O&M training and OSHA action level training per 29 CFR 1926.62 (i) (2) lead training. In addition, as applicable, contractors must comply with the EPA RR&P training and certifications requirements listed in the RR&P section of this appendix. Copies of training certifications, including a refresher within the last 12 months, will be provided to the ES&A Department **prior** to the start of any project. Only personnel with the proper minimum training will be authorized to perform any disturbance to asbestos/lead paint or assumed asbestos/lead paint containing materials, or be in the adjacent area of a disturbance.

3. Notify the ES&A Department at **325-8490** and leave a message with the time, name of the technician doing the work, date and exact locations in the school where they will be performing any disturbance. This call should take place immediately prior to disturbance, this phone number (**325-8490**) will go to voice mail, and the contractors are to provide notifications with above identified information, 24 hours a day. The Contractor is also required to notify their assigned WCSD Construction Department Project Managers and Assistant Project Managers of scheduled disturbances so they can also verify compliance with the contractors approved disturbance procedures.

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4. Contractors must refer to this Material Disturbance Permit to determine what materials contain asbestos or lead and utilize the applicable lead/asbestos procedures. Some materials cannot be disturbed, and each specific material disturbance permit will identify what can be disturbed and provided material disturbance instructions. The minimum disturbance permits in this section of the material permit are in addition to any requirements listed in the material disturbance instructions. Any instance where 100% of the minimum asbestos/lead requirements are not followed, the District will immediately hire an environmental remediation contractor as well as an environmental consultant to properly clean up the contamination and perform air sampling. The contractor will be responsible for reimbursing the District for all costs due to any improper or unauthorized disturbances.

5. Contractors or technicians who are new to performing asbestos/lead paint or assumed asbestos/lead paint disturbances for the District must contact the Capital Projects PM/PCI Department and schedule a disturbance. A Capital Projects PM/PCI employee will be scheduled to review the technician's compliance with the disturbance procedures in the field. Once a technician has demonstrated on a minimum of two (2) occasions to the Capital Projects Department that he has an understanding of the District disturbance requirements and has proper equipment, the ES&A Department will then authorize that technician to perform disturbances without prior approval of the Capital Projects Department. Notifications prior to starting all disturbances as listed above will still be required and technicians should expect unannounced random compliance inspections, from the ES&A Department. A list of approved technicians is available upon request form the ES&A department.

6. Post the appropriate "Danger Lead - Keep Out" or "Danger Asbestos Keep Out" signs on the entry side of all doors leading into classrooms, hallways, bathrooms, offices or mechanical rooms where drilling is to occur. Doors will be closed. It is the contractor /technician's responsibility to take adequate means to keep the public or school staff out of the disturbance area.

7. Large rooms, such as multipurpose rooms, will have yellow caution tape placed across all entries to the room in addition to signage but access to these areas must be restricted to ensure no unprotected person can enter the areas where disturbances are taking place. If unprotected personnel can see the activity, this is not a large enough area of demarcation.

8. A 6 ml plastic drop will be placed under the disturbance in a manner that extends 6' out in all directions from the disturbance area. This poly drop can be reused if properly wet-wiped or HEPA-vacuumed off after use.

9. Worker will don the respiratory protection and a protective suit, (protective suits are optional for lead disturbance, "attachments and penetration" disturbances if the Contractor will not exceed the lead action level) and initiate personal air monitoring procedures per item #10 below. Respiratory protection is required throughout all asbestos/lead paint or assumed asbestos/lead paint disturbances in WCSD regardless of air sampling results.

10. If a Contractor is performing a **lead** attachments and penetrations (see the definition in #20 below), air sampling will be conducted at the start of the project. If air sampling results show the technicians performing the work is below the OSHA Lead Action Level, air sampling can be suspended unless the work being performed is changed. Air sampling will be performed for each type of lead attachment and penetration activity to develop a representative sample for each lead activity. Air sampling will be performed during **all** asbestos disturbances, no exceptions.

11. Drill the hole or holes as required using an HEPA VAC and a shrouded or dust collecting apparatus (i.e. Bit Buddy. A HEPA VAC is to remain running during this whole process to ensure all debris is cleared from hole. All clean-up must be conducted the HEPA Vacuum. If a contractor fails to properly control the asbestos/lead containing dust, the District will then hire an environmental remediation contractor as well as an environmental consultant to properly clean up the contamination. The contractor will be responsible for reimbursing the District for all costs due to improper disturbances that result in debris exiting the area of disturbance.

12. All HEPA vacuums used will have been DOP challenge tested prior to first use and annually thereafter. If this project involves 30 or more disturbances over the span of this project, the HEPA vacuum will be DOP tested on-site prior to the start of the project.

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13. If required, to be determined by the technician, an encapsulant material may be sprayed or brushed on to the area of the holes.

14. A device, backing, box or raceway, or any other equipment will then be mounted using anchors installed per #11 above, with the HEPA VAC running and properly directed at the area of the disturbance.

15. A HEPA VAC or wet methods will be used to clean up any debris on 6ml poly drop, around device box, technician's suit, and any surfaces below holes, such as tops of chalkboards and base boards.

16. The poly drop, if utilized, will be folded into itself in such a manner as to not spread any debris, the HEPA vacuum hose sealed, and personal air monitoring time logged appropriately. This poly drop can be reused if it is properly wet-wiped or HEPA-vacuumed off after use.

17. All signs and equipment are to be removed, and the technician is to move to the next location. The contaminated suit should be removed and a new suit utilized at the new disturbance location, unless the suit can be properly decontaminated.

18. Upon completion of a shift, air samples will be dated and sent in to a properly accredited lab to be analyzed. Results will be forwarded to WCSD. Lab results will be e-mailed directly from the lab to the ES&A Department within 48 hours of the disturbance. All lab results will reference the Material Disturbance Permit (MDP) # located on the top of the first page of this permit. Results without the MDP number prefix will be returned to the lab for clarification and the addition of the MDP tracking number

19. All debris, waste, poly drop, suits, etc. will be placed in 6 mil poly waste bags (double bagged) and disposed of properly.

20. The definition of "Attachment and Penetrations" in this document is **only** the drilling of holes through a HEPA shrouded device, the installation of screws through a HEPA shrouded device, or the removal of screws through a HEPA shrouded device. **Any other activity** that is not attachments and penetrations as listed in item #20 must be designed by an asbestos or lead project designer, done per a lead specification, and supervised by the District or District hired outside asbestos/lead consultant. Contractors cannot perform any work, other than "Attachments and Penetrations" without an onsite District or District hired asbestos or Lead Consultant being present.

21. All asbestos abatement or lead disturbances, other than "Attachment and Penetrations", must be completed in full compliance with applicable regulations, the District's Asbestos Abatement Specifications, and District hired asbestos or lead consultants supplement specifications. If in error, an asbestos abatement bid or quote is put forth without the District Asbestos Abatement Specifications, Contractors are required to request a copy of the most current asbestos abatement specifications from the bid or quote entity through the formal bid inquiry process

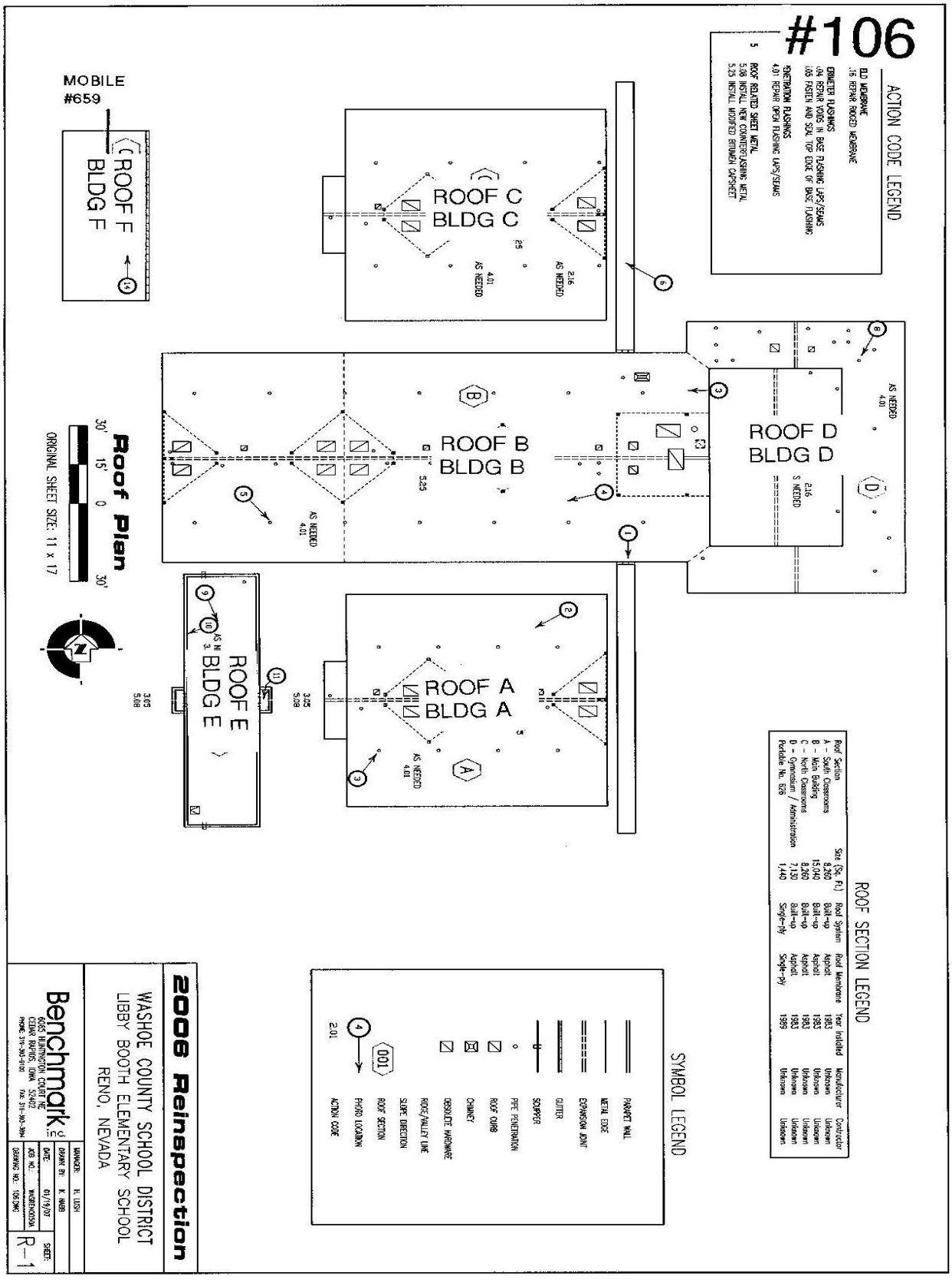
THE UNDERSIGNED AGREES TO COMPLY WITH THE CONDITIONS OF THIS MATERIAL, WATER & LEAD DISTURBANCE PERMIT, APPENDIXES, & ALL APPLICABLE REGULATIONS. UNDERSIGNED ACKNOWLEDGES LIABILITY FOR ANY COSTS THE DISTRICT MAY INCUR TO INVESTIGATE & CLEAN UP ANY DISCOVERY OF IMPROPER AND/OR UNAUTHORIZED DISTURBANCES DONE BY UNDERSIGNED'S EMPLOYEE(S) OR SUB-CONTRACTOR(S) TO MATERIALS LISTED AS LEAD/ASBESTOS-CONTAINING BY THE DISTRICT. IN ADDITION, THE UNDERSIGNED AGREES TO ALL REQUIREMENTS OF THE WATER & LEAD APPENDIX.

SIGNED BY (PRINT): _____SIGNATURE: _____

COMPANY (PRINT): _____

DATE RECEIVED: _____

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Project Specific Lead Sampling Results – Appendix #1.

A limited project lead-specific paints and coatings survey has been conducted. The sampling has been requested by the District Project Manager, and completed by the ES&A department. The results of that lead sampling are below. The results listed below apply ONLY to the locations and paint and coating colors listed below. This information cannot be applied to other areas that are not specifically addressed below. If additional sampling is required in the Contractor's opinion, the Contractor must relay that information to the District Project Manager. The Project Manager will determine if additional sampling will be conducted. If additional sampling will be done, a new MDP will be required. Contractors or their representatives cannot perform any asbestos or lead sampling.

Any paints or coatings that are not specifically addressed on this permit, or on the project drawings, has to be assumed to be lead containing, and above 5000 parts per million (lead based) – no exceptions. Any disturbance to those paints and coatings not specifically addressed on this permit, or on the project drawings must be done by properly trained (Minimum of OSHA action level training) personnel, and those disturbances must be performed in accordance with all lead requirements listed in this permit, as well as any applicable regulations and local requirements. Many times scope modifications are required after the bid, and new areas of the facility may need to be disturbed. These areas would not have been addressed on this permit, since they were unknown at the time of issuance. Additional sampling could be conducted by requesting lead sampling through their project's Project Manager, but there will be a delay getting sampling requests and a new MDP would be required. The District reserves the right to direct the Contractor to assume new paints and coatings, due to scope changes, are lead containing and the contractor would then be required to treat all paints and coatings as lead containing in compliance with all requirements of this permit.

LEAD CONTAINING PAINTS AND COATING

LOCATION	TYPE OF PAINTED SURFACE	COLOR	RESULTS
See Map*	White porcelain toilets	White	Lead based
See Map*	metal door frames	Dark navy	Lead containing
See Map*	concrete floor	Gray	Lead containing
See Map*	metal beams – SW playground	Gray	Lead containing
See Map*	drywall	light gray	Lead containing
See Map*	CMU wall	pastel yellow	Lead containing
See Map*	False ceiling panels	white	Lead containing

NON-LEAD CONTAINING PAINTS AND COATINGS

LOCATION	TYPE OF PAINTED SURFACE	COLOR	RESULTS
See Map*	metal beam	brown	Lead free
See Map*	metal column	gray blue	Lead free
See Map*	metal column	tan	Lead free
See Map*	acoustic wall tiles	white	Lead free
See Map*	drywall	white	Lead free

- If map is required contact the Project Manager for map.

FACS
Forensic Analytical Consulting Services

March 24, 2026

Asbestos & Lead Survey Report

Washoe County School District
Booth Elementary School
Site Modernization Project
1450 Stewart Street
Reno, NV 89502

Prepared for:

Teresa Poulsen, Director
Planning and Design
Capital Projects and Planning
Washoe County School District
14101 Old Virginia Road
Reno, NV 89521
(775) 789-3838 | t.poulsen@washoeschools.net

Prepared By:

Daniel Prado, Assistant Director
Forensic Analytical Consulting Services
4600 Kietzke Lane, B118
Reno, NV 89502
775-391-3524 | danny.prado@facs.com

FACS Project #PJ90910

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List of Acronyms

AAC	Asbestos Abatement Consultant
ACM	Asbestos Containing Material
AHERA	Asbestos Hazard Emergency Response Act
AIHA	American Industrial Hygiene Association
CFR	Code of Federal Regulation
DIR	Division of Industrial Relations
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency (EPA)
FACS	Forensic Analytical Consulting Services, Inc.
LCP	Lead-Containing Paints and Coatings
LBP	Lead-Based Paints and Coatings
ND	None Detected
NESHAP	National Emissions Standard Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Science and Technology
NVLAP	National Voluntary Laboratory Accreditation Program
PCM	Phase Contrast Microscopy
PLM	Polarized Light Microscopy
TEM	Transmission Electron Microscopy
TTLC	Total Threshold Limit Concentration

Executive Summary

Forensic Analytical Consulting Services, Inc. (FACS) was retained by Washoe County School District to perform a project-specific asbestos and lead paint survey of Booth Elementary School, located at 1450 Stewart Street in Reno, Nevada. The survey was limited to suspect asbestos-containing materials (ACM) and suspect paints and coatings which will be disturbed during an upcoming modernization project at the site. Appendix A of this report includes a Functional Spaces Notes Report for all spaces, suspect materials and components inspected during this survey. Appendix B of this report includes a lead paint sample summary table and an XRF Survey Data Table for all suspect paints and coatings sampled for lead as part of this survey. This survey was performed on various dates between February 19 and March 2, 2026.

Asbestos

The following material at the site was found to **contain asbestos** by laboratory analysis:

- **Cementitious Panels (20% Chrysotile)**

The following materials were identified as suspect materials but were not sampled to avoid damage to the integrity of the material or the function of the mechanism.

- **Fire Doors**
- **Vibration Dampener**

These materials should be assumed to contain asbestos until they are accessible for testing to determine if they are asbestos-free.

Please refer to the attached Functional Spaces Notes Report in Appendix A for identification of materials and asbestos-content on a space-by-space basis. Materials will be listed as being non-suspect for asbestos, sampled and found to be none-detect for asbestos, or will be identified as assumed, known, or quantified with a percentage of asbestos.

Any suspect materials not included in this inspection must be assumed to be asbestos-containing materials until tested and proven to be asbestos-free.

Lead

Multiple paints, coatings and components were found to be **lead-based** or **lead-containing** by XRF analysis or laboratory analysis. The spaces noted with components are spaces of sampling and these materials may exist in additional spaces.

Please refer to the summary tables and XRF Report Forms in Appendix B for a complete listing of lead-based, lead-containing, and lead-free paints.

Any paints or coatings not included in testing must be handled as lead-containing unless sampled and proven otherwise.

Introduction

Forensic Analytical Consulting Services, Inc. (FACS) was retained by Washoe County School District to perform a project-specific asbestos and lead paint survey of Booth Elementary School, located at 1450 Stewart Street in Reno, Nevada. The survey was limited to suspect asbestos-containing materials (ACM) and suspect paints and coatings which will be disturbed during an upcoming modernization project at the site. This survey was performed on various dates between February 19 and March 2, 2026.

Scope of Work

The purpose of this survey was to identify asbestos-containing materials (ACMs) and lead-containing paints and coatings in project-specific areas of Buildings B, D, and E, and select exterior locations, as part of the upcoming modernization project at the site. The visual inspection, bulk sampling, and survey documentation were performed by Daniel Prado, Ryan Hettich, Sydney Stedman, and Ty Bigham. Mr. Prado and Mr. Hettich are licensed by the Division of Industrial Relations (DIR) as Asbestos Abatement Consultants (AAC). Ms. Stedman and Mr. Bigham are licensed by the DIR as AAC Trainees. All are US EPA-accredited Asbestos Hazard Emergency Response Act Building Inspectors. Mr. Prado is also a US EPA Certified Lead Inspector/Assessor. The scope of the survey and the services provided by FACS included:

- Performing a visual inspection of the site to identify accessible suspect asbestos-containing materials (ACMs) present;
- Collection of bulk material samples for asbestos analysis by polarized light microscopy (PLM);
- Performing a visual inspection of the buildings and structures for suspect lead-containing paints and coatings and analyzing these materials using a x-ray fluorescence spectrum analyzer;
- Collection of bulk paint chip samples for lead analysis by inductively coupled plasma (ICP) analysis;
- Ensuring the technical quality of all work by using Asbestos Hazard Emergency Response Act (AHERA) accredited Building Inspectors;
- Ensuring the technical quality of all work by using US EPA Certified Lead Inspector / Assessors;
- Consolidating data and findings into a report format.

Site Characterization

Booth Elementary School is comprised of several single-story buildings on the campus. This survey was limited to project areas in Buildings B, D and E along with various outdoor locations on the west portion of the campus. Building B is a classroom wing, Building D contains the administration spaces and multipurpose room, and Building E is a modular building. The exterior areas included multiple playground structures and an awning.

The project areas in the buildings and the exterior locations are comprised of common building materials including, but not limited to, concrete, cementitious panels, duct insulation, drywall, carpet, baseboards, linoleum, false ceiling tile systems, vinyl floor tile, and associated mastics and sealants.

Survey Methods

Document Review

Original site plans and other documents provided by the Washoe County School District's planning department contact, Teresa Poulsen, were reviewed prior to conducting the survey.

Documents available from the Washoe County School District's Environmental Safety and Assessment Department were reviewed for past sampling results which were incorporated into this report based on the results of FACS' visual survey and identification of materials on District records.

Visual Inspection

Accessible building materials were visually inspected using the methods presented in the Federal AHERA regulations (40 CFR, Part 763). AHERA inspection methodology is required to be used for inspections of K-12 schools and is generally accepted as the industry standard for all ACM inspections regardless of structure or facility type. Suspect ACMs were also physically assessed for friability, condition and possible disturbance factors.

All areas were accessible during this inspection. Destructive methods used to investigate behind materials or above ceilings were performed as available, but not completed for areas with non-destructive materials, such as concrete or CMU walls. Review of provided plans were used to make determinations of potentially hidden materials within these areas as necessary.

Asbestos Inspection

Bulk Sample Collection

Bulk samples of identified homogeneous materials were collected from materials that may be impacted by the planned renovation activities. Samples were collected of each separate homogeneous area. A homogeneous area is defined as a surfacing material, thermal system insulation, or miscellaneous material that is uniform in use, color and texture. Examples of homogeneous areas could include:

Vinyl floor tiles
False ceiling panels
Drywall
Concrete

The specific number of samples collected was determined by using the methods required by the Federal AHERA regulations (40 CFR, Part 763.86) and ASTM standards as noted below:

1) For Surfacing Material:
   1,000 ft^2 or less – collect 3 samples
   1,001 to 5,000 ft^2 – collect 5 samples
   5,001 ft^2 or greater – collect 7 samples

2) For Thermal System Insulation:
   "In a randomly distributed manner" – collect 3 samples
   6 linear feet of patching or less – collect 1 sample
   cementitious pipe fittings – "In a manner sufficient to determine"

3) For all Miscellaneous Material:
Collect samples “In a manner sufficient to determine whether material is ACM (asbestos-containing material) or not ACM”…" – AHERA

The suspect ACMs were sampled using a knife, chisel, scraper, drill or other similar coring device suitable to the type of material sampled to cut through its entire thickness and to ensure that a cross-section of the material was obtained. The material was then placed in an appropriately labeled container that was sealed and delivered to the WCSD Environmental Safety and Assessment (ES&A) Department. A unique sample number was assigned to each sample.

Bulk Sample Analysis

A total of one hundred sixteen (116) bulk samples were collected from a total of thirty-eight (38) suspect materials.

All bulk samples were delivered to WCSD ES&A Department for submission to Schneider Laboratories Global, Inc. (SLG) in Richmond, Virginia.

SLG is accredited by the National Institute of Science and Technology’s (NIST) National Voluntary Laboratory Accreditation Program (NVLAP). SLG participates in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing Program and has substantial experience in the analysis of asbestos.

Samples were analyzed using Polarized Light Microscopy with Dispersion Staining (PLM/DS) techniques in accordance with the methodology approved by the U.S. Environmental Protection Agency (EPA). The percentage of asbestos present in the samples was determined on the basis of a visual area estimation. The EPA defines asbestos-containing materials (ACM) as any material containing more than one percent (1%) asbestos as determined using the method specified in Appendix A, Subpart F, 40 CFR Part 763, Section 1, Polarized Light Microscopy (PLM). 40 CFR Part 763 identifies the lower limit of reliable quantification for asbestos using the PLM method as approximately one percent (1%) by volume. In addition to the percentages, the types of asbestos minerals are also reported. The PLM method is the standard method used to analyze asbestos bulk samples.

When "None Detected" (ND) appears in the laboratory results, it should be interpreted as meaning asbestos was not observed in the sample material.

Lead Inspection

The client-defined lead inspection was modeled upon the sampling protocol described in “Chapter 7: Lead Based Paint Inspection” of the HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (1997 Revision).

OSHA, in Title 29 Code of Federal Regulations (CFR) Part Number 1926, Standard Number 1926.62, regulates all construction work where an employee may be occupationally exposed to lead. Paints, coatings, or materials with any detectable level of lead is considered lead-containing by OSHA. Paints or coatings containing lead above 1.0 mg/cm^2, 0.5% by weight, or 5,000 parts per million are considered lead-based by the US EPA.

For purposes of this report, materials containing lead shall be defined as materials that XRF testing has identified as containing a lead content at or above 0.01 mg/cm^2, or 0.00 mg/cm^2 readings which have not been confirmed with laboratory analysis of bulk samples. In addition, any laboratory analysis of bulk samples that find detectable concentrations of lead will be handled as lead-containing.

XRF Testing Methodology

Surfaces and components were surveyed for lead content utilizing a portable X-ray fluorescence (XRF) analyzer, Sci-Aps Model X-550PB, serial number 03539. The XRF analyzer contains an electrically powered x-ray cathode tube which bombards tested surfaces with X-rays and gamma rays. This external energy source excites any lead atoms within the tested paint or coating, causing their atoms to emit X-ray photons with a characteristic energy profile. The instrument analyzes the emitted energy to identify and quantify the amount of lead in the tested paint or coating, with lead content reported in milligrams per square centimeter.

Testing combinations of homogeneous components in one area are representative of similar components found in other areas with similar construction and painting histories. During this survey, the inspector visually identified the painted or coated component to test, an XRF reading was collected, and the reading was documented in the XRF data table contained in Appendix B. For each test reading, the data table identifies the room equivalent/space designation, the tested component name, the substrate material, the sample location, paint/coating color, condition assessment, and the XRF result expressed as lead content by weight in milligrams per square centimeter (mg/cm^2).

Bulk Sample Methodology

XRF testing performed during this survey was used to determine which paints or coatings at the site have detectable concentrations of lead, and to determine which paints or coatings at the site are lead-based paint. OSHA does not accept XRF test results for use in determining that a paint or coating does not contain lead. OSHA requires laboratory analysis of a bulk sample to classify a paint or coating as lead-free.

During this inspection, FACS personnel collected fifty-one (51) bulk paint chip samples from seventeen (17) suspect paints for laboratory confirmation of lead-content. These samples were scraped from the substrate using a knife or chisel to obtain sufficient material for analysis. Each sample was given a unique marker number, identified on a chain-of-custody, packaged, and were analyzed by Schneider Laboratories Global, Inc. (SLG) in Richmond, Virginia.

SLG is accredited by the American Industrial Hygiene Association's Environmental Lead Laboratory Accreditation Program for the analysis of lead in bulk paint chips by inductively coupled plasma.

Findings and Recommendations

Forensic Analytical Consulting Services, Inc. (FACS) was retained by Washoe County School District to perform a project-specific asbestos and lead paint survey of Booth Elementary School, located at 1450 Stewart Street in Reno, Nevada. This survey was performed on various dates between February 19 and March 2, 2026.

Asbestos

The following material at the site was found to **contain asbestos** by laboratory analysis:

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The following materials were identified as suspect materials but were not sampled to avoid damage to the integrity of the material or the function of the mechanism.

- **Fire Doors**
- **Vibration Dampener**

These materials should be assumed to contain asbestos until they are accessible for testing to determine if they are asbestos-free.

Please refer to the attached Functional Spaces Notes Report in Appendix A for identification of materials and asbestos-content on a space-by-space basis. Materials will be listed as being non-suspect for asbestos, sampled and found to be none-detect for asbestos, or will be identified as assumed, known, or quantified with a percentage of asbestos.

Any suspect materials not included in this inspection must be assumed to be asbestos-containing materials until tested and proven to be asbestos-free.

Asbestos abatement at this site would fall under the regulatory requirements of Northern Nevada Public Health. A 10-working day notification will need to be filed prior to the abatement of asbestos-containing materials if they are categorized as a regulated asbestos-containing material (RACM) or if they are non-friable materials that will be removed using mechanical means. Material disposal would be based on the friability of material, method of removal, and requirements of any other project-specific obligations.

To comply with the AHERA regulation and OSHA requirements, workers performing asbestos abatement will need to have AHERA Worker training with at least one worker trained to the AHERA Contractor-Supervisor level. Workers will need to use asbestos work practices required by OSHA for the appropriate abatement class of work being performed along with any project-specific work plans. A notification must be submitted to the local OSHA office for the abatement of asbestos-containing materials.

The contractor performing abatement of asbestos-containing materials will need to hold the A-23 license from the Nevada State Contractors Board and as required by the Nevada Administrative Code (NAC) 624.150(23).

Lead

Multiple paints, coatings and components were found to be **lead-based** or **lead-containing** by XRF analysis or laboratory analysis. The spaces noted with components are spaces of sampling and these materials may exist in additional spaces.

Please refer to the summary tables and XRF Report Forms in Appendix B for a complete listing of lead-based, lead-containing, and lead-free paints and coatings.

OSHA regulates the handling of paints and coatings containing lead down to any detectable concentration. Therefore, workers that will handle paints or coatings on this project must have lead training. For work with Washoe County School District, this training must be OSHA Action Level training at minimum. Any contractor with workers disturbing any quantity of detectable lead must perform an initial determination regarding worker exposures to lead, which may be based on personal air monitoring at the start of the project, prior employee monitoring from the past 12 months under workplace conditions closely resembling the current project, or objective data demonstrating that exposures will not exceed the OSHA action level (30 micrograms per cubic meter of air). It is the employer's responsibility to conduct the initial determination and comply with any relevant OSHA requirements.

Workers must use lead-safe work practices when disturbing paints or coatings that contain lead. Disturbance of lead-containing paints or coatings must be performed within a contained area to prevent the spread and build-up of lead dust. HEPA vacuums, dustless tools or shrouds, and/or intact removal of components should be employed to minimize lead dust generation and work areas must be properly cleaned following disturbance to lead-containing materials during this project. Waste generated during disturbance to lead-containing materials must be profiled in a hazardous waste determination to ascertain proper disposal requirements.

FACS recommends that the results of this report be incorporated into any renovation plans provided for this project for informational purposes.

Limitations

This investigation is limited to the conditions and practices observed, and information made available to FACS. The methods, conclusions and recommendations provided are based on FACS' judgment, expertise, and the standard of practice for professional service. They are subject to the limitations and variability inherent in the methodology employed. As with all environmental investigations, this investigation is limited to the defined scope and does not purport to set forth all hazards, nor indicate that other hazards do not exist.

Please do not hesitate to contact our office at 775-993-7389 with any questions or concerns. Thank you for the opportunity to assist Washoe County School District with promoting worker safety and a healthy environment.

Respectfully,
FORENSIC ANALYTICAL



Zachary Ramos
Project Manager, Reno
IJM-2341
US EPA LBP-I-I255969-1

Reviewed by:
FORENSIC ANALYTICAL



Daniel Prado
Assistant Director, Reno
IJPM-2057
US EPA LBP-R-I214705-3

Appendix A

Asbestos Functional Space Notes, Asbestos Sample Chain-of-Custody and Laboratory Results Report

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

FACS Project Number: PJ90910

Date of Inspection: February 19, 2026

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01 - Building D (Admin) 1

02 - Building B 5

03 - Building E 9

04 - Playground Areas 10

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

FACS Project Number: PJ90910

Date of Inspection: February 19, 2026

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 01 - Building D (Admin)		**Room:**	**01 - Space 6 - 15 x 15 x 9**				
Floor:	Concrete	MISC	None Detected	1	36380	225 sq	
Floor:	VFT & Mastic - 24" Light Grey Speckled	MISC	None Detected	2	36382	225 sq	
Baseboard:	Vinyl Baseboard & Glue - 4" Black	MISC	None Detected	3		60 ln	
Walls:	CMU & Grout	MISC	None Detected	4		540 sq	
Ceiling:	ACT & Glue - 12" Random Hole	MISC	None Detected	5		225 sq	
Door:	Doorframe Sealant	MISC	None Detected	6	36394	60 ln	
Sink:	Sink Coating - Black	MISC	None Detected	8	36402	1 ea	
Window:	Window Sealant - Grey	MISC	None Detected	7	36398	10 ln	
Building: 01 - Building D (Admin)		**Room:**	**02 - Space 6R - 8 x 4 x 9**				
Floor:	Concrete	MISC	None Detected	1		32 sq	
Floor:	VFT & Mastic - 24" Light Grey Speckled	MISC	None Detected	2	36383, 36384	32 sq	
Baseboard:	Vinyl Baseboard & Glue - 6" Black	MISC	None Detected	11	36412	24 ln	
Walls:	CMU & Grout	MISC	None Detected	4		162 sq	
Walls:	Drywall - Stipple Texture	MISC	None Detected	9	36405	54 sq	
Walls:	FRP & Glue - Pebble	MISC	None Detected	10		30 sq	
Ceiling:	ACT & Glue - 12" Random Hole	MISC	None Detected	5	36393	32 sq	
Door:	Doorframe Sealant	MISC	None Detected	6		15 ln	
Other:	Restroom Sealant - White	MISC	None Detected	12	36414	10 ln	
Window:	Window Sealant - Grey	MISC	None Detected	7		5 ln	
Building: 01 - Building D (Admin)		**Room:**	**03 - Space 7A - 14 x 11 x 9**				
Floor:	Carpet & Mastic - Red Multi	MISC	None Detected	13	36417, 36418	154 sq	
Floor:	Concrete	MISC	None Detected	1		154 sq	
Baseboard:	Vinyl Baseboard & Glue - 4" Black	MISC	None Detected	3		50 ln	
Walls:	CMU & Grout	MISC	None Detected	4		225 sq	
Walls:	Drywall - Stipple Texture	MISC	None Detected	9		225 sq	
Ceiling:	ACT & Glue - 12" Random Hole	MISC	None Detected	5		154 sq	
Door:	Doorframe Sealant	MISC	None Detected	6		30 ln	
Door:	Fire Door - 20 Minute Rating	MISC	Assumed	14		1 ea	No
	Comment: Fire Doors not sampled to maintain fire rating.						
Window:	Window Sealant - Grey	MISC	None Detected	7		10 ln	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

FACS Project Number: PJ90910

Date of Inspection: February 19, 2026

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts		Friable? Yes/No
Building: 01 - Building D (Admin)		**Room:**	**04 - Space 7A Entry - 5 x 5 x 9**					
Floor:	Carpet & Mastic - Red Multi	MISC	None Detected	13	36419	25	sq	
Floor:	Concrete	MISC	None Detected	1		25	sq	
Baseboard:	Vinyl Baseboard & Glue - 4" Black	MISC	None Detected	3		20	ln	
Walls:	CMU & Grout	MISC	None Detected	4		45	sq	
Walls:	Drywall - Stipple Texture	MISC	None Detected	9	36403	135	sq	
Ceiling:	ACT & Glue - 12" Random Hole	MISC	None Detected	5		25	sq	
Door:	Doorframe Sealant	MISC	None Detected	6		30	ln	
Door:	Fire Door - 20 Minute Rating	MISC	Assumed	14		1	ea	No
Comment:	*Fire Doors not sampled to maintain fire rating.*							
Building: 01 - Building D (Admin)		**Room:**	**05 - Space 9 - 30 x 16 x 9**					
Floor:	Carpet & Mastic - Blue Multi	MISC	None Detected	15	36420, 36421, 36422	480	sq	
Floor:	Concrete	MISC	None Detected	1		480	sq	
Baseboard:	Vinyl Baseboard & Glue - 4" Black	MISC	None Detected	3	36385	92	ln	
Walls:	CMU & Grout	MISC	None Detected	4		828	sq	
Walls:	Drywall - Stipple Texture	MISC	None Detected	9	36404	120	sq	
Comment:	*Mother's Room*							
Ceiling:	ACT & Glue - 12" Random Hole	MISC	None Detected	5	36392	480	sq	
Door:	Doorframe Sealant	MISC	None Detected	6		45	ln	
Window:	Window Sealant - Grey	MISC	None Detected	7		15	ln	
Room Comments:	*Includes Mother's Room Closet*							

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District
Site: Booth Elementary School
FACS Project Number: PJ90910
Date of Inspection: February 19, 2026

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts		Friable? Yes/No
Building: 01 - Building D (Admin)		**Room:**	**06 - Space 10 - 66 x 42 x 13**					
Floor:	Concrete	MISC	None Detected	1	36381	2772	sq	
Floor:	VSF & Glue - Blue Specks	MISC	None Detected	17	36426, 36427, 36428	554	sq	
Floor:	VSF & Glue - Light Grey Specks	MISC	None Detected	16	36424, 36425	2218	sq	
Baseboard:	Vinyl Baseboard & Glue - 6" Black	MISC	None Detected	11	36413	216	ln	
Walls:	ACT & Glue - Textured Pinhole	MISC	None Detected	18	36429, 36430, 36431	1404	sq	
Walls:	CMU & Grout	MISC	None Detected	4	36388	2808	sq	
Ceiling:	FCP - 2' x 4' Textured Pinhole	MISC	None Detected	19	36432, 36433, 36434	2772	sq	
Pipe Panels:	Cementitious Panels	MISC	20 % Ch	21	36438, 36439, 36440	40	sq	No
Door:	Doorframe Sealant	MISC	None Detected	6		210	ln	
Ducts:	Duct Mastic	MISC	None Detected	20	36435	70	sq	
Pipes:	Foam Insulation & Glue	TSI	None Detected	23	36441, 36442, 36443	20	ln	
Ducts:	Vibration Dampener - Black	MISC	Assumed	22		2	ea	No
Comment: Vibration Dampeners not sampled to maintain the integrity of the system.								
Building: 01 - Building D (Admin)		**Room:**	**07 - Space 10 Entry - 12 x 12 x 9**					
Floor:	Concrete	MISC	None Detected	1		144	sq	
Floor:	VSF & Glue - Light Grey Specks	MISC	None Detected	16	36423	144	sq	
Baseboard:	Vinyl Baseboard & Glue - 6" Black	MISC	None Detected	11	36411	48	ln	
Walls:	CMU & Grout	MISC	None Detected	4		402	sq	
Walls:	Concrete	MISC	None Detected	1		30		
Ceiling:	ACT & Glue - 12" Random Hole	MISC	None Detected	5	36391	144	sq	
Door:	Window Sealant - Grey	MISC	None Detected	7	36397	30	ln	
Comment: Storefront								
Building: 01 - Building D (Admin)		**Room:**	**08 - Space 11 - 8 x 7 x 8**					
Floor:	Concrete	MISC	None Detected	1		56	sq	
Floor:	Linoleum & Glue - Blue Wave	MISC	None Detected	24	36444	56	sq	
Baseboard:	Linoleum & Glue - Blue Wave	MISC	None Detected	24	36445	30	ln	
Walls:	Drywall - Scatter Texture	MISC	None Detected	25		240	sq	
Walls:	FRP & Glue - Pebble	MISC	None Detected	10	36410	240	sq	
Ceiling:	Drywall - Scatter Texture	MISC	None Detected	25	36447	56	sq	
Door:	Doorframe Sealant	MISC	None Detected	6		15	ln	
Other:	Restroom Sealant - White	MISC	None Detected	12	36415	10	ln	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

FACS Project Number: PJ90910

Date of Inspection: February 19, 2026

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 01 - Building D (Admin)		**Room:**	**09 - Space 12 - 8 x 7 x 8**				
Floor:	Concrete	MISC	None Detected	1		56 sq	
Floor:	Linoleum & Glue - Blue Wave	MISC	None Detected	24	36446	56 sq	
Baseboard:	Linoleum & Glue - Blue Wave	MISC	None Detected	24		30 ln	
Walls:	Drywall - Scatter Texture	MISC	None Detected	25		240 sq	
Walls:	FRP & Glue - Pebble	MISC	None Detected	10	36408, 36409	240 sq	
Ceiling:	Drywall - Scatter Texture	MISC	None Detected	25	36448, 36449	56 sq	
Door:	Doorframe Sealant	MISC	None Detected	6	36395	15 ln	
Other:	Restroom Sealant - White	MISC	None Detected	12	36416	10 ln	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

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Date of Inspection: February 19, 2026

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 02 - Building B		**Room:**	**01 - Space B1 - 30 x 28 x 11**				
Floor:	Carpet & Mastic - Multicolored	MISC	None Detected	26	36450, 36451, 36452	820 sq	
Floor:	Carpet & Mastic - Red Walkoff	MISC	None Detected	27	36453, 36454, 36455	20 sq	
Floor:	Concrete	MISC	None Detected	1		840 sq	
Baseboard:	Vinyl Baseboard & Glue - 4" Black	MISC	None Detected	3		116 ln	
Walls:	CMU & Grout	MISC	None Detected	4		638 sq	
Walls:	Drywall - Knockdown Texture	MISC	None Detected	28		120 sq	
	Comment: Above Restroom						
Walls:	Drywall - Stipple Texture	MISC	None Detected	9	36406, 36407	638 sq	
Ceiling:	Metal Panels	NON	Non-Suspect				
Door:	Doorframe Sealant	MISC	None Detected	6		60 ln	
Ducts:	Duct Mastic	MISC	None Detected	20	36437	20 sq	
Window:	Window Sealant - Grey	MISC	None Detected	7		20 ln	
Building: 02 - Building B		**Room:**	**02 - Space B1RB - 5 x 5 x 8**				
Floor:	Concrete	MISC	None Detected	1		25 sq	
Floor:	Epoxy - Grey	MISC	None Detected	29	36460	25 sq	
Walls:	CMU & Grout	MISC	None Detected	4		120 sq	
Walls:	Drywall - Knockdown Texture	MISC	None Detected	28	36457	40 sq	
Walls:	Epoxy - Grey	MISC	None Detected	29		60 sq	
Ceiling:	Drywall - Knockdown Texture	MISC	None Detected	28		25 sq	
Door:	Doorframe Sealant	MISC	None Detected	6		30 ln	
Other:	Restroom Sealant - White	MISC	None Detected	12		5 ln	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

FACS Project Number: PJ90910

Date of Inspection: February 19, 2026

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 02 - Building B		**Room:**	**03 - Space B1A - 30 x 28 x 11**				
Floor:	Concrete	MISC	None Detected	1	36379	840 sq	
Floor:	Epoxy Coating - Grey Flecks	MISC	None Detected	30	36462, 36463, 36464	672 sq	
Floor:	VSF & Glue - Grey/Tan Specks	MISC	None Detected	31	36467	168 sq	
Baseboard:	Vinyl Baseboard & Glue - 4" Black	MISC	None Detected	3		116 ln	
Walls:	Bulletin Board Panels - Brown	MISC	None Detected	32	36468	766 sq	
Walls:	CMU & Grout	MISC	None Detected	4		1276 sq	
Ceiling:	Metal Panels	NON	Non-Suspect				
Door:	Doorframe Sealant	MISC	None Detected	6		90 ln	
Ducts:	Duct Mastic	MISC	None Detected	20		20 sq	
Sink:	Sink Coating - Black	MISC	None Detected	8	36400, 36401	1 ea	
Window:	Window Sealant - Grey	MISC	None Detected	7	36399	20 ln	
Building: 02 - Building B		**Room:**	**04 - Space B1RG - 5 x 5 x 8**				
Floor:	Concrete	MISC	None Detected	1		25 sq	
Floor:	Epoxy - Grey	MISC	None Detected	29	36459	25 sq	
Walls:	CMU & Grout	MISC	None Detected	4	36389	120 sq	
Walls:	Drywall - Knockdown Texture	MISC	None Detected	28		40 sq	
Walls:	Epoxy - Grey	MISC	None Detected	29		60 sq	
Ceiling:	Drywall - Knockdown Texture	MISC	None Detected	28		25 sq	
Door:	Doorframe Sealant	MISC	None Detected	6		30 ln	
Other:	Restroom Sealant - White	MISC	None Detected	12		5 ln	
Building: 02 - Building B		**Room:**	**05 - Staff Restoom - 5 x 5 x 8**				
Floor:	Concrete	MISC	None Detected	1		25 sq	
Floor:	Epoxy - Grey	MISC	None Detected	29		25 sq	
Walls:	CMU & Grout	MISC	None Detected	4		120 sq	
Walls:	Drywall - Knockdown Texture	MISC	None Detected	28		40 sq	
Walls:	Epoxy - Grey	MISC	None Detected	29		60 sq	
Ceiling:	Drywall - Knockdown Texture	MISC	None Detected	28		25 sq	
Door:	Doorframe Sealant	MISC	None Detected	6		30 ln	
Other:	Restroom Sealant - White	MISC	None Detected	12		5 ln	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

FACS Project Number: PJ90910

Date of Inspection: February 19, 2026

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 02 - Building B		**Room:**	**06 - Space B10 - 28 x 26 x 11**				
Floor:	Carpet & Mastic - Blue/Tan	MISC	None Detected	33	36473	655 sq	
Floor:	Concrete	MISC	None Detected	1		728 sq	
Floor:	VSF & Glue - Grey/Tan Specks	MISC	None Detected	31	36466	73 sq	
Baseboard:	Vinyl Baseboard & Glue - 4" Black	MISC	None Detected	3	36386	108 ln	
Walls:	Bulletin Board Panels - Brown	MISC	None Detected	32	36470	1188 sq	
Walls:	CMU & Grout	MISC	None Detected	4		1188 sq	
Ceiling:	Metal Panels	NON	Non-Suspect				
Door:	Doorframe Sealant	MISC	None Detected	6	36396	60 ln	
Ducts:	Duct Mastic	MISC	None Detected	20	36436	20 sq	
Window:	Window Sealant - Grey	MISC	None Detected	7		10 ln	
Building: 02 - Building B		**Room:**	**07 - Space B10R - 5 x 5 x 8**				
Floor:	Concrete	MISC	None Detected	1		25 sq	
Floor:	Epoxy - Grey	MISC	None Detected	29		25 sq	
Walls:	CMU & Grout	MISC	None Detected	4		120 sq	
Walls:	Drywall - Knockdown Texture	MISC	None Detected	28	36458	40 sq	
Walls:	Epoxy - Grey	MISC	None Detected	29		60 sq	
Ceiling:	Drywall - Knockdown Texture	MISC	None Detected	28		25 sq	
Door:	Doorframe Sealant	MISC	None Detected	6		30 ln	
Other:	Restroom Sealant - White	MISC	None Detected	12		5 ln	
Building: 02 - Building B		**Room:**	**08 - Space B11 - 28 x 26 x 11**				
Floor:	Carpet & Mastic - Blue/Tan	MISC	None Detected	33	36471, 36472	655 sq	
Floor:	Concrete	MISC	None Detected	1		728 sq	
Floor:	VSF & Glue - Grey/Tan Specks	MISC	None Detected	31	36465	73 sq	
Baseboard:	Vinyl Baseboard & Glue - 4" Black	MISC	None Detected	3		108 ln	
Walls:	Bulletin Board Panels - Brown	MISC	None Detected	32	36469	1188 sq	
Walls:	CMU & Grout	MISC	None Detected	4		1188 sq	
Ceiling:	Metal Panels	NON	Non-Suspect				
Door:	Doorframe Sealant	MISC	None Detected	6		60 ln	
Ducts:	Duct Mastic	MISC	None Detected	20		20 sq	
Window:	Window Sealant - Grey	MISC	None Detected	7		10 ln	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

FACS Project Number: PJ90910

Date of Inspection: February 19, 2026

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 02 - Building B		**Room:**	**09 - Space B11R - 5 x 5 x 8**				
Floor:	Concrete	MISC	None Detected	1		25 sq	
Floor:	Epoxy - Grey	MISC	None Detected	29	36461	25 sq	
Walls:	CMU & Grout	MISC	None Detected	4	36390	120 sq	
Walls:	Drywall - Knockdown Texture	MISC	None Detected	28	36456	40 sq	
Walls:	Epoxy - Grey	MISC	None Detected	29		60 sq	
Ceiling:	Drywall - Knockdown Texture	MISC	None Detected	28		25 sq	
Door:	Doorframe Sealant	MISC	None Detected	6		30 ln	
Other:	Restroom Sealant - White	MISC	None Detected	12		5 ln	

Note: Pipe chases between the restroom walls in Building B were inspected. No new suspect materials (pipe wrap, etc.) were observed.

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

FACS Project Number: PJ90910

Date of Inspection: February 19, 2026

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 03 - Building E		**Room:**	**01 - Space E3 - 19 x 8 x 8**				
Floor:	Carpet & Mastic - Black/Tan Squares	MISC	None Detected	35	36477, 36478, 36479	152 sq	
Floor:	VFT & Mastic - 12" White/Lt Blue	MISC	None Detected	34	36474, 36475, 36476	152 sq	
	Comment: Under Carpet						
Baseboard:	Vinyl Baseboard & Glue - 4" Black	MISC	None Detected	3	36387	54 ln	
Walls:	Tackboard - Tan	MISC	None Detected	36	36480, 36481, 36482	432 sq	
Ceiling:	FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	37	36483, 36484, 36485	152 sq	
Door:	Fire Door - 20 Minute Rating	MISC	Assumed	14		2 ea	No
	Comment: Fire Doors not sampled to maintain fire rating.						

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Booth Elementary School

FACS Project Number: PJ90910

Date of Inspection: February 19, 2026

Building: 04 - Playground Areas

Building Comment: *Located on West Side of Campus*

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 04 - Playground Areas		**Room:**	**01 - Playground Areas - 500 x 170 x 0**				
Courts:	Concrete	MISC	None Detected	1	36486	30 sq	
Footings:	Concrete	MISC	None Detected	1	36487	120 sq	
Awning:	Concrete	MISC	None Detected	1	36488	225 sq	
	Comment: Pad						
Awning:	Concrete Sealant	MISC	None Detected	38	36489, 36490, 36491	70 ln	
Play Structures:	Rubberized Coating & Glue	MISC	None Detected	39	36492, 36493, 36494	110 sq	

Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Washoe County School District (4991)
Address: 7495 S. Virginia Street
Reno, NV 89511

Order #: 675677

Attn:

Received 03/09/26
Analyzed 03/12/26
Reported 03/12/26

Project:
Location: 106 Libby Booth ES
Number:

PO Number: PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-001	02/27/26	106-6058-36379	SW Center		
Layer 1: Concrete Gray/Black, Hard/Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-002	02/27/26	106-6058-36380	N Side W End @ DR		
Layer 1: Concrete Gray/Black, Hard/Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-003	02/27/26	106-6058-36381	W Side S End @ DR		
Layer 1: Concrete Gray/Black, Hard/Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-004	02/27/26	106-6058-36382	S Side E End		
Layer 1: Vinyl Floor Tile Light Gray, Organically Bound No mastic found.				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-005	02/27/26	106-6058-36383	W Side S End		
Layer 1: Vinyl Floor Tile Light Gray, Organically Bound				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Mastic Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-006	02/27/26	106-6058-36384	NW Center		
Layer 1: Vinyl Floor Tile Light Gray, Organically Bound				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Mastic Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-007	02/27/26	106-6058-36385	N Side W End		
Layer 1: BBM4" Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-008	02/27/26	106-6058-36386	S Side E End		
Layer 1: BBM4" Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-009	02/27/26	106-6058-36387	NW Corner		
Layer 1: BBM4" Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-010	02/27/26	106-6058-36388	S Side W End		
Layer 1: CMU Black/Gray/Red, Cementitious/Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Grout Gray, Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-011	02/27/26	106-6058-36389	NE Corner		
Layer 1: CMU Black/Gray/Red, Cementitious/Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Grout Gray, Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-012	02/27/26	106-6058-36390	SE Corner		
Layer 1: CMU Black/Gray/Red, Cementitious/Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Grout Gray, Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-013	02/27/26	106-6058-36391	SE Corner		
Layer 1: Acoustical Tile Tan/White, Fibrous				No Asbestos Detected	90% CELLULOSE FIBER 10% NON FIBROUS MATERIAL
Layer 2: Glue Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-014	02/27/26	106-6058-36392	NW Corner		
Layer 1: Acoustical Tile Tan/White, Fibrous No glue found.				No Asbestos Detected	90% CELLULOSE FIBER 10% NON FIBROUS MATERIAL
675677-015	02/27/26	106-6058-36393	NW Corner		
Layer 1: Acoustical Tile Tan/White, Fibrous No glue found.				No Asbestos Detected	90% CELLULOSE FIBER 10% NON FIBROUS MATERIAL
675677-016	02/27/26	106-6058-36394	W Side N End		
Layer 1: Doorframe Sealant White, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-017	02/27/26	106-6058-36395	S Side Center & DR		
Layer 1: Doorframe Sealant Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-018	02/27/26	106-6058-36396	NE Corner		
Layer 1: Doorframe Sealant White, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-019	02/27/26	106-6058-36397	E Side Center		
Layer 1: Window Sealant Black, Rubbery No gray color found.				No Asbestos Detected	100% NON FIBROUS MATERIAL
Sample not as described on COC.					
675677-020	02/27/26	106-6058-36398	W Side E End		
Layer 1: Window Sealant Gray, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-021	02/27/26	106-6058-36399	N Side E End		
Layer 1: Window Sealant White, Soft No gray color found.				No Asbestos Detected	100% NON FIBROUS MATERIAL
Sample not as described on COC.					
675677-022	02/27/26	106-6058-36400	S Side E End		
Layer 1: Sink Coating Black, Bituminous/Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-023	02/27/26	106-6058-36401	S Side E End		
Layer 1: Sink Coating Black, Bituminous/Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-024	02/27/26	106-6058-36402	NE Corner		
Layer 1: Sink Coating Black, Bituminous/Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-025	02/27/26	106-6058-36403	SE Corner		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Stipple Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number:

PO Number: PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-026	02/27/26	106-6058-36404	E Side N End		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Stipple Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-027	02/27/26	106-6058-36405	S Side E End		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Stipple Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-028	02/27/26	106-6058-36406	N Side W End		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Stipple Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-029	02/27/26	106-6058-36407	S Side W End		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Stipple Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-030	02/27/26	106-6058-36408	NW Corner		
Layer 1: FRP White, Fibrous/Hard No glue found.				No Asbestos Detected	70% MINERAL/GLASS WOOL 30% NON FIBROUS MATERIAL
675677-031	02/27/26	106-6058-36409	NE Corner		
Layer 1: FRP White, Fibrous/Hard				No Asbestos Detected	70% MINERAL/GLASS WOOL 30% NON FIBROUS MATERIAL
Layer 2: Glue Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-032	02/27/26	106-6058-36410	NE Corner		
Layer 1: FRP White, Fibrous/Hard				No Asbestos Detected	70% MINERAL/GLASS WOOL 30% NON FIBROUS MATERIAL
Layer 2: Glue Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-033	02/27/26	106-6058-36411	NW Corner		
Layer 1: BBM6" Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-034	02/27/26	106-6058-36412	E Side Center		
Layer 1: BBM6" Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-035	02/27/26	106-6058-36413	W Side S End		
Layer 1: BBM6" Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-036	02/27/26	106-6058-36414	S Side Center		
Layer 1: Restroom Sealant White, Soft No BBM6" found. **Sample not as described on COC.**				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-037	02/27/26	106-6058-36415	S Side Center		
Layer 1: Restroom Sealant White, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-038	02/27/26	106-6058-36416	W Side S End		
Layer 1: Restroom Sealant White, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-039	02/27/26	106-6058-36417	SW Corner		
Layer 1: Carpet Red, Fibrous				No Asbestos Detected	10% NON FIBROUS MATERIAL 90% SYNTHETIC FIBER
Layer 2: Mastic Beige, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-040	02/27/26	106-6058-36418	NE Corner		
Layer 1: Carpet Red, Fibrous				No Asbestos Detected	10% NON FIBROUS MATERIAL 90% SYNTHETIC FIBER
Layer 2: Mastic Beige, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-041	02/27/26	106-6058-36419	NW Corner		
Layer 1: Carpet Red, Fibrous				No Asbestos Detected	10% NON FIBROUS MATERIAL 90% SYNTHETIC FIBER
Layer 2: Mastic Beige, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-042	02/27/26	106-6058-36420	E of Center		
Layer 1: Carpet Blue, Fibrous				No Asbestos Detected	10% NON FIBROUS MATERIAL 90% SYNTHETIC FIBER
Layer 2: Mastic Beige, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-043	02/27/26	106-6058-36421	S Side Center		
Layer 1: Carpet Blue, Fibrous				No Asbestos Detected	10% NON FIBROUS MATERIAL 90% SYNTHETIC FIBER
Layer 2: Mastic Beige, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-044	02/27/26	106-6058-36422	S Side W End		
Layer 1: Carpet Blue, Fibrous				No Asbestos Detected	10% NON FIBROUS MATERIAL 90% SYNTHETIC FIBER
Layer 2: Mastic Beige, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-045	02/27/26	106-6058-36423	N Side E End		
Layer 1: Vinyl Sheet Flrng Light Gray, Rubbery No glue found.				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-046	02/27/26	106-6058-36424	S Side W End		
Layer 1: Vinyl Sheet Flrng Light Gray, Rubbery No glue found.				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-047	02/27/26	106-6058-36425	W Side S End		
Layer 1: Vinyl Sheet Flrng Light Gray, Rubbery No glue found.				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-048	02/27/26	106-6058-36426	N of Center		
Layer 1: Vinyl Sheet Flrng Blue, Rubbery				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Glue Beige, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-049	02/27/26	106-6058-36427	Center		
Layer 1: Vinyl Sheet Flrng Blue, Rubbery				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Glue Beige, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-050	02/27/26	106-6058-36428	S of Center		
Layer 1: Vinyl Sheet Flrng Blue, Rubbery				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Glue Beige, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-051	02/27/26	106-6058-36429	W Side S End		
Layer 1: Acoustical Tile Gray/White, Fibrous No glue found.				No Asbestos Detected	40% CELLULOSE FIBER 30% MINERAL/GLASS WOOL 10% NON FIBROUS MATERIAL 20% PERLITE/PUMICE

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-052	02/27/26	106-6058-36430	N Side E End		
Layer 1: Acoustical Tile Gray/White, Fibrous No glue found.				No Asbestos Detected	40% CELLULOSE FIBER 30% MINERAL/GLASS WOOL 10% NON FIBROUS MATERIAL 20% PERLITE/PUMICE
675677-053	02/27/26	106-6058-36431	NE Corner		
Layer 1: Acoustical Tile Gray/White, Fibrous No glue found.				No Asbestos Detected	40% CELLULOSE FIBER 30% MINERAL/GLASS WOOL 10% NON FIBROUS MATERIAL 20% PERLITE/PUMICE
675677-054	02/27/26	106-6058-36432	SW Corner		
Layer 1: FCP2"X4" Gray/White, Fibrous				No Asbestos Detected	40% CELLULOSE FIBER 20% FOAMED GLASS 30% MINERAL/GLASS WOOL 10% NON FIBROUS MATERIAL
675677-055	02/27/26	106-6058-36433	W Side S End		
Layer 1: FCP2"X4" Gray/White, Fibrous				No Asbestos Detected	40% CELLULOSE FIBER 30% MINERAL/GLASS WOOL 10% NON FIBROUS MATERIAL 20% PERLITE/PUMICE
675677-056	02/27/26	106-6058-36434	NW Corner		
Layer 1: FCP2"X4" Gray/White, Fibrous				No Asbestos Detected	40% CELLULOSE FIBER 30% MINERAL/GLASS WOOL 10% NON FIBROUS MATERIAL 20% PERLITE/PUMICE
675677-057	02/27/26	106-6058-36435	E Side S End		
Layer 1: Duct Mastic White, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-058	02/27/26	106-6058-36436	NE of Center		
Layer 1: Duct Mastic White, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-059	02/27/26	106-6058-36437	SW of Center		
Layer 1: Duct Mastic White, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL

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Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-060	02/27/26	106-6058-36438	W Side S End @ Damage		
Layer 1: Cementitous Panels Gray, Cementitious/Hard				20% CHRYSOTILE	80% NON FIBROUS MATERIAL
675677-061	02/27/26	106-6058-36439	W Side S End @ Damage		
Layer 1: Cementitous Panels Gray, Cementitious/Hard				20% CHRYSOTILE	80% NON FIBROUS MATERIAL
675677-062	02/27/26	106-6058-36440	W Side S End @ Damage		
Layer 1: Cementitous Panels Gray, Cementitious/Hard				20% CHRYSOTILE	80% NON FIBROUS MATERIAL
675677-063	02/27/26	106-6058-36441	W Side N End		
Layer 1: Foam Insulation Yellow, Fibrous No glue found.				No Asbestos Detected	95% MINERAL/GLASS WOOL 5% NON FIBROUS MATERIAL
675677-064	02/27/26	106-6058-36442	W Side N End		
Layer 1: Foam Insulation Yellow, Fibrous No glue found.				No Asbestos Detected	95% MINERAL/GLASS WOOL 5% NON FIBROUS MATERIAL
675677-065	02/27/26	106-6058-36443	W Side S End		
Layer 1: Foam Insulation Yellow, Fibrous No glue found.				No Asbestos Detected	95% MINERAL/GLASS WOOL 5% NON FIBROUS MATERIAL
675677-066	02/27/26	106-6058-36444	SW Corner		
Layer 1: Linoleum Blue, Rubbery				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Glue Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-067	02/27/26	106-6058-36445	SW Corner		
Layer 1: Linoleum Blue, Organically Bound				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Glue Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-068	02/27/26	106-6058-36446	S Side Corner		
Layer 1: Linoleum Blue, Rubbery				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Glue Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-069	02/27/26	106-6058-36447	SE Corner		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Scatter Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-070	02/27/26	106-6058-36448	SW Corner		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Scatter Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-071	02/27/26	106-6058-36449	NE Corner		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Scatter Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-072	02/27/26	106-6058-36450	N Side E End		
Layer 1: Carpet Multi-Colored, Fibrous/Spongy				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Mastic Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-073	02/27/26	106-6058-36451	NE Corner		
Layer 1: Carpet Multi-Colored, Fibrous/Spongy				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Mastic Yellow, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-074	02/27/26	106-6058-36452	E Side Center		
Layer 1: Carpet Multi-Colored, Fibrous/Spongy No masitc found.				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
675677-075	02/27/26	106-6058-36453	NE Corner		
Layer 1: Carpet Red, Fibrous/Spongy No mastic found.				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
675677-076	02/27/26	106-6058-36454	N Side W End		
Layer 1: Carpet Red, Fibrous/Spongy No mastic found.				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
675677-077	02/27/26	106-6058-36455	NW Corner		
Layer 1: Carpet Red, Fibrous/Spongy No mastic found.				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number:

PO Number: PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-078	02/27/26	106-6058-36456	SE Corner		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Knockdown Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-079	02/27/26	106-6058-36457	NE Corner		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Knockdown Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-080	02/27/26	106-6058-36458	NE Corner		
Layer 1: Drywall White, Powdery				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Layer 2: Knockdown Texture White, Granular				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-081	02/27/26	106-6058-36459	SW Corner		
Layer 1: Epoxy Gray, Soft/Brittle				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-082	02/27/26	106-6058-36460	NE Corner		
Layer 1: Epoxy Gray, Soft/Brittle				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-083	02/27/26	106-6058-36461	S Side Center		
Layer 1: Epoxy Gray, Soft/Brittle				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-084	02/27/26	106-6058-36462	NE of Center		
Layer 1: Epoxy Coating Gray, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL

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Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-085	02/27/26	106-6058-36463	SE of Center		
Layer 1: Epoxy Coating Gray, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-086	02/27/26	106-6058-36464	SE of Center		
Layer 1: Epoxy Coating Gray, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-087	02/27/26	106-6058-36465	NW of Center		
Layer 1: Vinyl Sheet Flrng Gray/Tan, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2: Glue Tan, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-088	02/27/26	106-6058-36466	SW of Center		
Layer 1: Vinyl Sheet Flrng Gray, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2: Glue Tan, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-089	02/27/26	106-6058-36467	E Side Center		
Layer 1: Vinyl Sheet Flrng Gray, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2: Glue Tan, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-090	02/27/26	106-6058-36468	E Side Center		
Layer 1: Bulletin Board Panels Brown, Foamy				No Asbestos Detected	80% CORK 10% CELLULOSE FIBER 10% NON FIBROUS MATERIAL
675677-091	02/27/26	106-6058-36469	SE Corner		
Layer 1: Bulletin Board Panels Brown, Foamy				No Asbestos Detected	80% CORK 10% CELLULOSE FIBER 10% NON FIBROUS MATERIAL

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Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-092	02/27/26	106-6058-36470	NE Corner		
Layer 1: Bulletin Board Panels Brown, Foamy				No Asbestos Detected	80% CORK 10% CELLULOSE FIBER 10% NON FIBROUS MATERIAL
675677-093	02/27/26	106-6058-36471	NW Corner		
Layer 1: Carpet Blue/Tan, Fibrous/Spongy				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Mastic Tan, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-094	02/27/26	106-6058-36472	NW Corner		
Layer 1: Carpet Blue, Fibrous/Spongy				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Mastic Tan, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-095	02/27/26	106-6058-36473	SW Corner		
Layer 1: Carpet Blue, Fibrous/Spongy				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Mastic Tan, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-096	02/27/26	106-6058-36474	N Side E End		
Layer 1: Vinyl Floor Tile White/Light Blue, Organically Bound				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Mastic Black, Bituminous				No Asbestos Detected	100% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-097	02/27/26	106-6058-36475	NW Corner		
Layer 1: Vinyl Floor Tile White/Light Blue, Organically Bound				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Mastic Black, Bituminous				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-098	02/27/26	106-6058-36476	E Side Center @ DR		
Layer 1: Vinyl Floor Tile White/Light Blue, Organically Bound				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
Layer 2: Mastic Black, Bituminous				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-099	02/27/26	106-6058-36477	NW Corner		
Layer 1: Carpet Black/Tan, Fibrous/Spongy				No Asbestos Detected	70% CELLULOSE FIBER 30% NON FIBROUS MATERIAL
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Mastic Off White, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-100	02/27/26	106-6058-36478	SW Corner		
Layer 1: Carpet Black/Tan, Fibrous/Spongy				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Mastic Off White, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-101	02/27/26	106-6058-36479	SW Corner		
Layer 1: Carpet Black/Tan, Fibrous/Spongy				No Asbestos Detected	30% NON FIBROUS MATERIAL 70% SYNTHETIC FIBER
Sample was inhomogenous, subsamples of each component were analyzed separately.					
Layer 2: Mastic Off White, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number: **PO Number:** PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763 **PLM Analysis**

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-102	02/27/26	106-6058-36480	N Side E End		
Layer 1: Drywall White, Powdery No tackbaord found.				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Sample not as described on COC.					
675677-103	02/27/26	106-6058-36481	E Side N End		
Layer 1: Drywall White, Powdery No tackbaord found.				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Sample not as described on COC.					
675677-104	02/27/26	106-6058-36482	E Side S End		
Layer 1: Drywall White, Powdery No tackbaord found.				No Asbestos Detected	4% CELLULOSE FIBER 2% MINERAL/GLASS WOOL 94% NON FIBROUS MATERIAL
Sample not as described on COC.					
675677-105	02/27/26	106-6058-36483	SE Corner		
Layer 1: FCP2"X4" Gray/White, Fibrous				No Asbestos Detected	40% CELLULOSE FIBER 30% MINERAL/GLASS WOOL 10% NON FIBROUS MATERIAL 20% PERLITE/PUMICE
675677-106	02/27/26	106-6058-36484	NE Corner		
Layer 1: FCP2"X4" Gray/White, Fibrous				No Asbestos Detected	40% CELLULOSE FIBER 30% MINERAL/GLASS WOOL 10% NON FIBROUS MATERIAL 20% PERLITE/PUMICE
675677-107	02/27/26	106-6058-36485	NW Corner		
Layer 1: FCP2"X4" Gray/White, Fibrous				No Asbestos Detected	40% CELLULOSE FIBER 30% MINERAL/GLASS WOOL 10% NON FIBROUS MATERIAL 20% PERLITE/PUMICE
675677-108	02/27/26	106-6058-36486	N Basketball Crt W Side		
Layer 1: Concrete Gray, Hard/Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-109	02/27/26	106-6058-36487	N Side C Plygrnd S Side		
Layer 1: Concrete Gray, Hard/Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Project:
Location: 106 Libby Booth ES
Number:

PO Number: PO134874

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
675677-110	02/27/26	106-6058-36488	SW Crnr SW Awning		
Layer 1: Concrete Gray, Hard/Granular				No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
675677-111	02/27/26	106-6058-36489	N Side E End SW Awning		
Layer 1: Concrete Sealant Gray, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-112	02/27/26	106-6058-36490	NE Crnr SW Awning		
Layer 1: Concrete Sealant Gray, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-113	02/27/26	106-6058-36491	SW Crnr SW Awning		
Layer 1: Concrete Sealant Gray, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-114	02/27/26	106-6058-36492	N Side C Plygrnd S Side		
Layer 1: Rubberized Coating Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-115	02/27/26	106-6058-36493	N Side C Plygrnd E Side		
Layer 1: Rubberized Coating Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL
675677-116	02/27/26	106-6058-36494	N Side C Plygrnd N Side		
Layer 1: Rubberized Coating Black, Rubbery				No Asbestos Detected	100% NON FIBROUS MATERIAL

EPA Regulatory Limit: 1%

Total layers analyzed on order: 161

675677-03/12/26 05:54 PM

Analyst **Eisen Zhao**

Reviewed By: **Thoria Nadiem**
Microscopy Manager

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. Laboratory estimated asbestos error rates available upon request. The test results apply to the sample as received.

Charge to CE

WCSD BULK SAMPLE CHAIN OF CUSTODY FORM

Requested By: John Nolan **Phone Number: 775-325-8491** **Fax Number: 775-851-5662**

nalysis Type: PLM, PCM, TEM **Analysis Turn Around Time: 2hr, Same Day, 1 Day, 2 Day, 3 Day, 5 Day**

Instructions: Email results to the ESA Department, and produce a separate report for each facility. New prefix numbers on a sample identifies a new site. ACCT. #4991

SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36379	2/27/2026	Concrete	SW of Center	B1A	106 - Libby Booth ES
106 - 6058 - 36380	2/27/2026	Concrete	N Side W End @ Door	6	106 - Libby Booth ES
106 - 6058 - 36381	2/27/2026	Concrete	W Side S End @ Door	10	106 - Libby Booth ES
106 - 6058 - 36382	2/27/2026	VFT & Mastic 24" light grey speckled	S Side E End	6	106 - Libby Booth ES
106 - 6058 - 36383	2/27/2026	VFT & Mastic 24" light grey speckled	W Side S End	6R	106 - Libby Booth ES
106 - 6058 - 36384	2/27/2026	VFT & Mastic 24" light grey speckled	NW Corner	6R	106 - Libby Booth ES
106 - 6058 - 36385	2/27/2026	BBM 4" Black	N Side W End	9	106 - Libby Booth ES
106 - 6058 - 36386	2/27/2026	BBM4" Black	S Side E End	B10	106 - Libby Booth ES
106 - 6058 - 36387	2/27/2026	BBM4" Black	NW Corner	E3	106 - Libby Booth ES
106 - 6058 - 36388	2/27/2026	CMU & Grout	S Side W End	10	106 - Libby Booth ES
106 - 6058 - 36389	2/27/2026	CMU & Grout	NE Corner	B1RG	106 - Libby Booth ES
106 - 6058 - 36390	2/27/2026	CMU & Grout	SE Corner	B11R	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00 PM

RECEIVED BY: [signature] **DATE/TIME:** 3-9-26 1:06 pm

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

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Charge to CE

WCSD BULK SAMPLE CHAIN OF CUSTODY FORM

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SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36391	2/27/2026	ACT & Glue - 12" Random hole	SE Corner	10 Entry	106 - Libby Booth ES
106 - 6058 - 36392	2/27/2026	ACT & Glue 12" Random Hole	NW Corner	9	106 - Libby Booth ES
106 - 6058 - 36393	2/27/2026	ACT & Glue 12" Random Hole	NW Corner	6R	106 - Libby Booth ES
106 - 6058 - 36394	2/27/2026	Doorframe Sealant	W Side N End	6	106 - Libby Booth ES
106 - 6058 - 36395	2/27/2026	Doorframe Sealant	S Side Center & Door	12	106 - Libby Booth ES
106 - 6058 - 36396	2/27/2026	Doorframe Sealant	NE Corner	B10	106 - Libby Booth ES
106 - 6058 - 36397	2/27/2026	Window Sealant - grey	E Side Center	10 Entry	106 - Libby Booth ES
106 - 6058 - 36398	2/27/2026	Window Sealant - Grey	W Side E End	6	106 - Libby Booth ES
106 - 6058 - 36399	2/27/2026	Window Sealant - Grey	N Side E End	B1A	106 - Libby Booth ES
106 - 6058 - 36400	2/27/2026	Sink Coating - Black	S Side E End	B1A	106 - Libby Booth ES
106 - 6058 - 36401	2/27/2026	Sink Coating - Black	S Side E End	B1A	106 - Libby Booth ES
106 - 6058 - 36402	2/27/2026	Sink Coating - Black	NE Corner	6	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00 PM

RECEIVED BY: Jenna Brew **DATE/TIME:** 3-9-26 1:06 pm

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

Charge to CE

WCSD BULK SAMPLE CHAIN OF CUSTODY FORM

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SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36403	2/27/2026	Drywall - Stipple Texture	SE Corner	7A Entry	106 - Libby Booth ES
106 - 6058 - 36404	2/27/2026	Drywall - Stipple Texture	E Side N End	9	106 - Libby Booth ES
106 - 6058 - 36405	2/27/2026	Drywall - Stipple Texture	S Side E End	6R	106 - Libby Booth ES
106 - 6058 - 36406	2/27/2026	Drywall - Stipple Texture	N Side W End	B1	106 - Libby Booth ES
106 - 6058 - 36407	2/27/2026	Drywall - Stipple Texture	S Side W End	B1	106 - Libby Booth ES
106 - 6058 - 36408	2/27/2026	FRP & Glue	NW Corner	12	106 - Libby Booth ES
106 - 6058 - 36409	2/27/2026	FRP & Glue	NE Corner	12	106 - Libby Booth ES
106 - 6058 - 36410	2/27/2026	FRP & Glue	NE Corner	11	106 - Libby Booth ES
106 - 6058 - 36411	2/27/2026	BBM 6" Black	NW Corner	10 Entry	106 - Libby Booth ES
106 - 6058 - 36412	2/27/2026	BBM 6" Black	E Side Center	6R	106 - Libby Booth ES
106 - 6058 - 36413	2/27/2026	BBM 6" Black	W Side S End	10	106 - Libby Booth ES
106 - 6058 - 36414	2/27/2026	BBM 6" Black	S Side Center	6R	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00PM

RECEIVED BY: Nuna Bew **DATE/TIME:** 3-9-26 9:06pm

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

Charge to CE.

WCSD BULK SAMPLE CHAIN OF CUSTODY FORM

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nalysis Type: PLM, PCM, TEM **Analysis Turn Around Time: 2hr, Same Day, 1 Day, 2 Day, 3 Day, 5 Day**

Instructions: Email results to the ESA Department, and produce a separate report for each facility. New prefix numbers on a sample identifies a new site. ACCT. #4991

SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36415	2/27/2026	Restroom Sealant - white	S Side Center	11	106 - Libby Booth ES
106 - 6058 - 36416	2/27/2026	Restroom Sealant - White	W Side S End	12	106 - Libby Booth ES
106 - 6058 - 36417	2/27/2026	Carpet & Mastic Red Multi	SW Corner	7A	106 - Libby Booth ES
106 - 6058 - 36418	2/27/2026	Carpet & Mastic Red Multi	NE Corner	7A	106 - Libby Booth ES
106 - 6058 - 36419	2/27/2026	Carpet & Mastic Red Multi	NW Corner	7A Entry	106 - Libby Booth ES
106 - 6058 - 36420	2/27/2026	Carpet & Mastic - Blue Multi	E of Center	9	106 - Libby Booth ES
106 - 6058 - 36421	2/27/2026	Carpet & Mastic - Blue Multi	S Side Center	9	106 - Libby Booth ES
106 - 6058 - 36422	2/27/2026	Carpet & Mastic - Blue Multi	S Side W End	9	106 - Libby Booth ES
106 - 6058 - 36423	2/27/2026	VSF & Glue - Light grey specks	N Side E End	10 Entry	106 - Libby Booth ES
106 - 6058 - 36424	2/27/2026	VSF & Glue - Light grey specks	S Side W End	10	106 - Libby Booth ES
106 - 6058 - 36425	2/27/2026	VSF & Glue - Light grey specks	W Side S End	10	106 - Libby Booth ES
106 - 6058 - 36426	2/27/2026	VSF & Glue - Blue Specks	N of Center	10	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00 PM

RECEIVED BY: [signature] **DATE/TIME:** 3-9-26 1:06pm

RECEIVED BY: _____ **DATE/TIME:** _____

RECEIVED BY: _____ **DATE/TIME:** _____

Charge to CC

WCSD BULK SAMPLE CHAIN OF CUSTODY FORM

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Instructions: Email results to the ESA Department, and produce a separate report for each facility. New prefix numbers on a sample identifies a new site. ACCT. #4991

SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36427	2/27/2026	VSF & Glue - Blue Specks	Center	10	106 - Libby Booth ES
106 - 6058 - 36428	2/27/2026	VSF & Glue - Blue Specks	S of Center	10	106 - Libby Booth ES
106 - 6058 - 36429	2/27/2026	ACT & Glue - Textured Pinhole	W Side S End	10	106 - Libby Booth ES
106 - 6058 - 36430	2/27/2026	ACT & Glue - Textured Pinhole	N Side E End	10	106 - Libby Booth ES
106 - 6058 - 36431	2/27/2026	ACT & Glue - Textured Pinhole	NE Corner	10	106 - Libby Booth ES
106 - 6058 - 36432	2/27/2026	FCP 2'x4' Textured Pinhole	SW Corner	10	106 - Libby Booth ES
106 - 6058 - 36433	2/27/2026	FCP 2'x4' Textured Pinhole	W Side S End	10	106 - Libby Booth ES
106 - 6058 - 36434	2/27/2026	FCP 2'x4' Textured Pinhole	NW Corner	10	106 - Libby Booth ES
106 - 6058 - 36435	2/27/2026	Duct Mastic	E Side S End	10	106 - Libby Booth ES
106 - 6058 - 36436	2/27/2026	Duct Mastic	NE of Center	B10	106 - Libby Booth ES
106 - 6058 - 36437	2/27/2026	Duct Mastic	SW of Center	B1	106 - Libby Booth ES
106 - 6058 - 36438	2/27/2026	Cementitious Panels	W Side S End @ Damage	10	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00 PM

RECEIVED BY: [signature] **DATE/TIME:** 3-9-26 1:06pm

RECEIVED BY: _____ **DATE/TIME:** _____

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Charge to CC

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Instructions: Email results to the ESA Department, and produce a separate report for each facility. New prefix numbers on a sample identifies a new site. ACCT. #4991

SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36439	2/27/2026	Cementitious Panels	W side S End @ Damage	10	106 - Libby Booth ES
106 - 6058 - 36440	2/27/2026	Cementitious Panels	W Side S End @ Damage	10	106 - Libby Booth ES
106 - 6058 - 36441	2/27/2026	Foam Insualtion & Glue	W Side N End	10	106 - Libby Booth ES
106 - 6058 - 36442	2/27/2026	Foam Insulation & Glue	W Side N End	10	106 - Libby Booth ES
106 - 6058 - 36443	2/27/2026	Foam Insulation & Glue	W Side S End	10	106 - Libby Booth ES
106 - 6058 - 36444	2/27/2026	Linoleum & Glue - Blue Wav	SW Corner	11	106 - Libby Booth ES
106 - 6058 - 36445	2/27/2026	Linoleum & Glue - Blue Wav	SW Corner	11	106 - Libby Booth ES
106 - 6058 - 36446	2/27/2026	Linoleum & Glue - Blue Wav	S Side Center	12	106 - Libby Booth ES
106 - 6058 - 36447	2/27/2026	Drywall Scatter Texture	SE Corner	11	106 - Libby Booth ES
106 - 6058 - 36448	2/27/2026	Drywall Scatter Texture	SW Corner	12	106 - Libby Booth ES
106 - 6058 - 36449	2/27/2026	Drywall Scatter Texture	NE Corner	12	106 - Libby Booth ES
106 - 6058 - 36450	2/27/2026	Carpet & Mastic - Multicolored	N Side E End	B1	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00 PM

RECEIVED BY: [signature] **DATE/TIME:** 3-9-26 1:06 pm

RECEIVED BY: **DATE/TIME:**

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Change to CE

WCSD BULK SAMPLE CHAIN OF CUSTODY FORM

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Instructions: Email results to the ESA Department, and produce a separate report for each facility. New prefix numbers on a sample identifies a new site. ACCT. #4991

SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36451	2/27/2026	Carpet & Mastic - Multicolored	NE Corner	B1	106 - Libby Booth ES
106 - 6058 - 36452	2/27/2026	Carpet & Mastic - Multicolored	E Side Center	B1	106 - Libby Booth ES
106 - 6058 - 36453	2/27/2026	Carpet & Mastic Red Walk c	NE Corner	B1	106 - Libby Booth ES
106 - 6058 - 36454	2/27/2026	Carpet & Mastic - Red walk off	N Side W End	B1	106 - Libby Booth ES
106 - 6058 - 36455	2/27/2026	Carpet & mastic - Red walk c	NW Corner	B1	106 - Libby Booth ES
106 - 6058 - 36456	2/27/2026	Drywall Knockdown Texture	SE corner	B11R	106 - Libby Booth ES
106 - 6058 - 36457	2/27/2026	Drywall Knockdown Texture	NE Corner	B1RB	106 - Libby Booth ES
106 - 6058 - 36458	2/27/2026	Drywall Knockdown Texture	NE corner	B10R	106 - Libby Booth ES
106 - 6058 - 36459	2/27/2026	Epoxy - Grey	SW Corner	B1RG	106 - Libby Booth ES
106 - 6058 - 36460	2/27/2026	Epoxy - Grey	NE Corner	B1RG	106 - Libby Booth ES
106 - 6058 - 36461	2/27/2026	Epoxy - Grey	S Side Center	B11R	106 - Libby Booth ES
106 - 6058 - 36462	2/27/2026	Epoxy Coating - Grey Flecks	NE of Center	B1A	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00 PM

RECEIVED BY: [signature] **DATE/TIME:** 3-9-26 1:06pm

RECEIVED BY: **DATE/TIME:**

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Charge to CE

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SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36463	2/27/2026	Epoxy Coating - Grey Flecks	SE of Center	B1A	106 - Libby Booth ES
106 - 6058 - 36464	2/27/2026	Epoxy Coating -Grey Flecks	SE of Center	B1A	106 - Libby Booth ES
106 - 6058 - 36465	2/27/2026	VSF & Glue - Grey/Tan Specks	NW OF Center	B11	106 - Libby Booth ES
106 - 6058 - 36466	2/27/2026	VSF & Glue - Grey/Tan Specks	SW of Corner	B10	106 - Libby Booth ES
106 - 6058 - 36467	2/27/2026	VSF & Glue - Grey/Tan Specks	E side Center	B1A	106 - Libby Booth ES
106 - 6058 - 36468	2/27/2026	Bulletin Board Panels - Brow	E Side Center	B1A	106 - Libby Booth ES
106 - 6058 - 36469	2/27/2026	Bulletin Board Panels - Brow	SE Corner	B11	106 - Libby Booth ES
106 - 6058 - 36470	2/27/2026	Bulletin Board Panels - Brow	NE Corner	B10	106 - Libby Booth ES
106 - 6058 - 36471	2/27/2026	Carpet & Mastic - Blue/Tan	NW Corner	B11	106 - Libby Booth ES
106 - 6058 - 36472	2/27/2026	Carpet & Mastic - Blue/Tan	NW Corner	B11	106 - Libby Booth ES
106 - 6058 - 36473	2/27/2026	Carpet & Mastic - Blue/Tan	SW Corner	B10	106 - Libby Booth ES
106 - 6058 - 36474	2/27/2026	VFT & Mastic - 12" White/Lt. Blue	N Side E End	E3	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00 PM

RECEIVED BY: Mark Bew **DATE/TIME:** 3-6-26 1:06 pm

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

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SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36475	2/27/2026	VFT & Mastic - 12" White/Lt. Blue	NW Corner	E3	106 - Libby Booth ES
106 - 6058 - 36476	2/27/2026	VFT & Mastic - 12" White/Lt. Blue	E Side Center @ Door	E3	106 - Libby Booth ES
106 - 6058 - 36477	2/27/2026	Carpet & Mastic - Black/Tan Squares	NW Corner	E3	106 - Libby Booth ES
106 - 6058 - 36478	2/27/2026	Carpet & Mastic - Black/Tan Squares	SW Corner	E3	106 - Libby Booth ES
106 - 6058 - 36479	2/27/2026	Carpet & Mastic - Black/Tan Squares	SW Corner	E3	106 - Libby Booth ES
106 - 6058 - 36480	2/27/2026	Tackboard - Tan	N Side E End	E3	106 - Libby Booth ES
106 - 6058 - 36481	2/27/2026	Tackboard - Tan	E Side N End	E3	106 - Libby Booth ES
106 - 6058 - 36482	2/27/2026	Tackboard - Tan	E Side S End	E3	106 - Libby Booth ES
106 - 6058 - 36483	2/27/2026	FCP - 2'x4' Pinhole Fissure	SE Corner	E3	106 - Libby Booth ES
106 - 6058 - 36484	2/27/2026	FCP - 2'x4' Pinhole Fissure	NE Corner	E3	106 - Libby Booth ES
106 - 6058 - 36485	2/27/2026	FCP - 2'x4' Pinhole Fissure	NW Corner	E3	106 - Libby Booth ES
106 - 6058 - 36486	2/27/2026	Concrete	North Basketball Court W Side Center	NBBC	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00 PM

RECEIVED BY: [signature] **DATE/TIME:** 3-9-26 1:06pm

RECEIVED BY: **DATE/TIME:**

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SAMPLE #	DATE	MAT. DESCRIPTION	LOCATION	ROOM	SITE
106 - 6058 - 36487	2/27/2026	Concrete	N Side C Playground S Side W End Footing	NSCP	106 - Libby Booth ES
106 - 6058 - 36488	2/27/2026	Concrete	S W Corner SW Awning	SWA	106 - Libby Booth ES
106 - 6058 - 36489	2/27/2026	Concrete Sealant - Grey	N Side E End SW Awning	SWA	106 - Libby Booth ES
106 - 6058 - 36490	2/27/2026	Concrete Sealant - Grey	NE Corner SW Awning	SWA	106 - Libby Booth ES
106 - 6058 - 36491	2/27/2026	Concrete Sealant - Grey	SW Corner SW Awning	SWA	106 - Libby Booth ES
106 - 6058 - 36492	2/27/2026	Rubberized Coating	N Side C Playground S Side Center	NSCP	106 - Libby Booth ES
106 - 6058 - 36493	2/27/2026	Rubberized Coating	N Side C Playground E Side Center	NSCP	106 - Libby Booth ES
106 - 6058 - 36494	2/27/2026	Rubberized Coating	N Side C Playground N Side Center	NSCP	106 - Libby Booth ES

SENT BY: Brian Priest **DATE/TIME:** 3-5-26 2:00 PM

RECEIVED BY: Kevin Benn **DATE/TIME:** 3-9-26 1:06 pm

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

Appendix B

Lead Paint Chip Summary, Sample Chain-of-Custody, Laboratory Results Report and XRF Report Form

Lead-Based Paints & Coatings

- White Porcelain Toilets

Lead-Containing Paints & Coatings

The following paints and coatings were found to be lead-containing by laboratory analysis:

- Dark Navy Paint on Metal Doors/Frames
- Grey Flecked Paint on Epoxy/Concrete Floor
- Grey Paint on Metal Beam
- Light Grey Paint on Drywall Wall
- Pastel Yellow Paint on CMU Wall

Lead-Free Paints & Coatings

- Blue Paint on Metal Pole
- Brown Paint on Metal Beam
- Golden Yellow Paint on Metal Railing
- Grey-Blue Paint on Metal Column
- Orange Paint on Plastic Tunnel
- Tan Paint on Metal Column
- White Paint on Acoustic Wall
- White Paint on Asphalt Basketball Court
- White Paint on Drywall Wall
- White Paint on FCP Ceiling
- Yellow Paint on Metal Pole
- Yellow Paint on Plastic Panel

All other paints and coatings in the surveyed areas were found to be lead-containing by XRF analysis.

Lead Paint Chip Summary (Lab Report # 676143) WCSD – Booth Elementary School – Site Modernization Survey Survey Date: February 19, 2026					
Sample Number	**Component Location**	**Component**	**Color**	**Substrate**	**Analytical Results (mg/kg)**
16709	E3 - W Side Center	Door Frame	Dark Navy	Metal	66.2
16710	E3 - W Side Center	Door	Dark Navy	Metal	81.8
16711	E3 - E Side Center	Door	Dark Navy	Metal	123
16712	B1A - N Side Center at Damage	Floor	Grey Flecks	Epoxy	12.3
16713	B1A - SW Corner at Damage	Floor	Grey Flecks	Epoxy	18.1
16714	B1A - E Side N End at Damage	Floor	Grey Flecks	Epoxy	< 12.0
16715	B1 - S Side Center	Wall	Light Grey	Drywall	< 9.31
16716	B1 - NW Corner	Wall	Light Grey	Drywall	< 9.75
16717	B1 - N Side Center	Wall	Light Grey	Drywall	47.9
16718	B1 - E Side Center at Damage	Wall	Pastel Yellow	Drywall	< 9.60
16719	B1 - NW Corner	Wall	Pastel Yellow	CMU	< 9.72
16720	B1 - SW Corner	Wall	Pastel Yellow	CMU	54.6
16721	10 - E Side N End	Wall	White	Acoustic	< 9.78
16722	6 - E Side N End	Wall	White	Acoustic	< 9.78
16723	10 - NE Corner	Wall	White	Acoustic	< 9.43
16724	10 - NW Corner	Ceiling	White	FCP	< 9.15
16725	10 - SW Corner	Ceiling	White	FCP	< 9.04
16726	10 - S Side W End	Ceiling	White	FCP	< 9.43
16727	7A Entry - NE Corner	Wall	White	Drywall	< 13.0
16728	Space 9 Closet - SE Corner	Wall	White	Drywall	< 9.40
16729	7A Entry - SE Corner	Wall	White	Drywall	< 9.07
16730	North Side Center Playground - NW Corner	Pole	Blue	Metal	< 34.1
16731	North of Center Playground - S Side Center	Pole	Blue	Metal	< 16.3
16732	North Side Center Playground - N Side Center	Pole	Blue	Metal	< 44.3

Lead Paint Chip Summary (Lab Report # 676143) WCSD – Booth Elementary School – Site Modernization Survey Survey Date: February 19, 2026					
Sample Number	**Component Location**	**Component**	**Color**	**Substrate**	**Analytical Results (mg/kg)**
16733	South Side Center Playground - SW of Center	Beam	Brown	Metal	< 9.85
16734	South Side Center Playground - E Side N End	Beam	Brown	Metal	< 16.4
16735	South Side Center Playground - N Side W End	Beam	Brown	Metal	< 9.57
16736	North of Center Playground - SE Corner	Railing	Golden Yellow	Metal	< 9.23
16737	North of Center Playground - NW Corner	Railing	Golden Yellow	Metal	< 9.66
16738	North of Center Playground - N Side W End	Railing	Golden Yellow	Metal	< 11.5
16739	SW Awning - SW Corner	Column	Grey Blue	Metal	< 9.85
16740	SW Awning - NW Corner	Column	Grey Blue	Metal	< 17.8
16741	SW Awning - NE Corner	Column	Grey Blue	Metal	< 9.75
16742	SW Playground - E of Center	Beam	Grey	Metal	< 11.9
16743	SW Playground - W of Center	Beam	Grey	Metal	< 10.4
16744	SW Playground - S Side Center	Beam	Grey	Metal	15.7
16745	North Side Center Playground - W of Center	Tunnel	Orange	Plastic	< 13.6
16746	North Side Center Playground - W of Center	Tunnel	Orange	Plastic	< 9.60
16747	North Side Center Playground - W of Center	Tunnel	Orange	Plastic	< 10.2
16748	South Side Center Playground - S Side W End	Column	Tan	Metal	< 9.37
16749	South Side Center Playground - S Side Center	Column	Tan	Metal	< 13.3
16750	South Side Center Playground - S Side W End	Column	Tan	Metal	< 10.3
16751	Center Basketball Court - Center of Court	Basketball Court	White	Asphalt	< 9.37
16752	North Basketball Court - NE Corner	Basketball Court	White	Asphalt	< 9.23
16753	South Basketball Court - N Side W End	Basketball Court	White	Asphalt	< 9.48
16754	North Side Center Playground - W Side Center	Pole	Yellow	Metal	< 20.3

Lead Paint Chip Summary (Lab Report # 676143) WCSD – Booth Elementary School – Site Modernization Survey Survey Date: February 19, 2026					
Sample Number	**Component Location**	**Component**	**Color**	**Substrate**	**Analytical Results (mg/kg)**
16755	North Side Center Playground - W Side Center	Pole	Yellow	Metal	< 20.2
16756	North Side Center Playground - SE Corner	Pole	Yellow	Metal	< 10.2
16757	North Side Center Playground - W Side Center	Panel	Yellow	Plastic	< 9.43
16758	North Side Center Playground - Center of Playground	Panel	Yellow	Plastic	< 9.48
16759	North Side Center Playground - Center of Playground	Panel	Yellow	Plastic	< 9.78

Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Washoe County School District (4991)
Address: 7495 S. Virginia Street
Reno, NV 89511

Attn:

Project:
Location: 106 Libby Booth ES
Number:

Order #: 676143

Matrix Paint
Received 03/11/26
Reported 03/13/26

PO Number: PO224939

Sample ID / Parameter	Cust. Sample ID	Location / Method	Result	RL*	Units	Analysis Date	Analyst
676143-001	106PB-6061-16709	W Side Cntr Door Frame					
Metals Analysis							
Lead		EPA 6010D / ME-003	**66.2**	12.1	mg/kg	03/12/26	DM
676143-002	106PB-6061-16710	W Side Cntr Door					
Metals Analysis							
Lead		EPA 6010D / ME-003	**81.8**	9.94	mg/kg	03/12/26	DM
676143-003	106PB-6061-16711	E Side Cntr Door					
Metals Analysis							
Lead		EPA 6010D / ME-003	**123**	12.9	mg/kg	03/12/26	DM
676143-004	106PB-6061-16712	N Side Cntr @ Damage FL					
Metals Analysis							
Lead		EPA 6010D / ME-003	**12.3**	11.6	mg/kg	03/12/26	DM
676143-005	106PB-6061-16713	SW Crnr @ Damage FL					
Metals Analysis							
Lead		EPA 6010D / ME-003	**18.1**	15.0	mg/kg	03/12/26	DM
676143-006	106PB-6061-16714	E Side N End @ Damage FL					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<12.0**	11.9	mg/kg	03/12/26	DM
676143-007	106PB-6061-16715	S Side Cntr Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.31**	9.31	mg/kg	03/12/26	DM
676143-008	106PB-6061-16716	NW Crnr Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.75**	9.75	mg/kg	03/12/26	DM
676143-009	106PB-6061-16717	N Side Cntr Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**47.9**	9.97	mg/kg	03/12/26	DM
676143-010	106PB-6061-16718	E Side Cntr @ Damage					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.60**	9.60	mg/kg	03/12/26	DM

All internal QC parameters were met. Unusual sample conditions, if any, are described. Surrogate Spike results designated with "D" indicate that the analyte was diluted out. "MI" indicates matrix interference. Concentration and *Reporting Limit (RL) based on areas provided by client. Values are reported to three significant figures. Solid PPM = mg/kg | PPB = µg/kg and Water PPM = mg/L | PPB = µg/L. The test results apply to the sample as received.

Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Washoe County School District (4991)
Address: 7495 S. Virginia Street
Reno, NV 89511

Attn:

Project:
Location: 106 Libby Booth ES
Number:

Order #: 676143

Matrix Paint
Received 03/11/26
Reported 03/13/26

PO Number: PO224939

Sample ID / Parameter	Cust. Sample ID	Location / Method	Result	RL*	Units	Analysis Date	Analyst
676143-011	106PB-6061-16719	NW Crnr Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.72**	9.72	mg/kg	03/12/26	DM
676143-012	106PB-6061-16720	SW Crnr Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**54.6**	10.2	mg/kg	03/12/26	DM
676143-013	106PB-6061-16721	E Side N End Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.78**	9.78	mg/kg	03/12/26	DM
676143-014	106PB-6061-16722	E Side N End Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.78**	9.78	mg/kg	03/12/26	DM
676143-015	106PB-6061-16723	NE Crnr Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.43**	9.42	mg/kg	03/12/26	DM
676143-016	106PB-6061-16724	NE Crnr Ceiling					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.15**	9.14	mg/kg	03/12/26	DM
Matrix spike failed for Pb due to possible interference. Sample results are unaffected.							
676143-017	106PB-6061-16725	SW Crnr Ceiling					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.04**	9.04	mg/kg	03/12/26	DM
676143-018	106PB-6061-16726	S Side W End Ceiling					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.43**	9.42	mg/kg	03/12/26	DM
676143-019	106PB-6061-16727	NE Crnr Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<13.0**	13.0	mg/kg	03/12/26	DM
676143-020	106PB-6061-16728	Space 9 Closet SE Crnr					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.40**	9.39	mg/kg	03/12/26	DM

All internal QC parameters were met. Unusual sample conditions, if any, are described. Surrogate Spike results designated with "D" indicate that the analyte was diluted out. "MI" indicates matrix interference. Concentration and *Reporting Limit (RL) based on areas provided by client. Values are reported to three significant figures. Solid PPM = mg/kg | PPB = µg/kg and Water PPM = mg/L | PPB = µg/L. The test results apply to the sample as received.

Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Washoe County School District (4991)
Address: 7495 S. Virginia Street
Reno, NV 89511

Attn:

Project:
Location: 106 Libby Booth ES
Number:

Order #: 676143

Matrix Paint
Received 03/11/26
Reported 03/13/26

PO Number: PO224939

Sample ID / Parameter	Cust. Sample ID	Location / Method	Result	RL*	Units	Analysis Date	Analyst
676143-021	106PB-6061-16729	SE Crnr Wall					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.07**	9.06	mg/kg	03/12/26	DM
676143-022	106PB-6061-16730	N Side Cntr Playground NW					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<34.1**	34.1	mg/kg	03/12/26	DM
676143-023	106PB-6061-16731	N Side Cntr Playground S					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<16.3**	16.2	mg/kg	03/12/26	DM
676143-024	106PB-6061-16732	N Side Cntr Playground N					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<44.3**	44.3	mg/kg	03/12/26	DM
676143-025	106PB-6061-16733	S Side Cntr Playground SW					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.85**	9.84	mg/kg	03/12/26	DM
676143-026	106PB-6061-16734	S Side Cntr Playground E					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<16.4**	16.3	mg/kg	03/12/26	DM
676143-027	106PB-6061-16735	S Side Cntr Playground N					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.57**	9.57	mg/kg	03/12/26	DM
676143-028	106PB-6061-16736	S Side Cntr Playground W					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.23**	9.23	mg/kg	03/12/26	DM
676143-029	106PB-6061-16737	N Cntr Playground SE Crnr					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.66**	9.66	mg/kg	03/12/26	DM
676143-030	106PB-6061-16738	N Cntr Playground N Side					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<11.5**	11.5	mg/kg	03/12/26	DM

All internal QC parameters were met. Unusual sample conditions, if any, are described. Surrogate Spike results designated with "D" indicate that the analyte was diluted out. "MI" indicates matrix interference. Concentration and *Reporting Limit (RL) based on areas provided by client. Values are reported to three significant figures. Solid PPM = mg/kg | PPB = µg/kg and Water PPM = mg/L | PPB = µg/L. The test results apply to the sample as received.

Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Washoe County School District (4991)
Address: 7495 S. Virginia Street
Reno, NV 89511

Attn:

Project:
Location: 106 Libby Booth ES
Number:

Order #: 676143

Matrix Paint
Received 03/11/26
Reported 03/13/26

PO Number: PO224939

Sample ID / Parameter	Cust. Sample ID	Location / Method	Result	RL*	Units	Analysis Date	Analyst
676143-031	106PB-6061-16739	SW Awning SW Crnr Clmn					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.85**	9.84	mg/kg	03/12/26	DM
676143-032	106PB-6061-16740	SW Awning NW Crnr Clmn					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<17.8**	17.7	mg/kg	03/12/26	DM
676143-033	106PB-6061-16741	SW Awning NE Crnr Clmn					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.75**	9.75	mg/kg	03/12/26	DM
676143-034	106PB-6061-16742	SW Playground E Cntr					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<11.9**	11.9	mg/kg	03/12/26	DM
676143-035	106PB-6061-16743	SW Playground W Cntr					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<10.4**	10.3	mg/kg	03/12/26	DM
676143-036	106PB-6061-16744	SW Playground S Side					
Metals Analysis							
Lead		EPA 6010D / ME-003	**15.7**	15.4	mg/kg	03/12/26	DM
676143-037	106PB-6061-16745	N Side Cntr Playground W					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<13.6**	13.5	mg/kg	03/12/26	DM
676143-038	106PB-6061-16746	N Side Cntr Playground W					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.60**	9.60	mg/kg	03/12/26	DM
676143-039	106PB-6061-16747	N Side Cntr Playground W					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<10.2**	10.2	mg/kg	03/12/26	DM
676143-040	106PB-6061-16748	S Side Cntr Playground S					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.37**	9.37	mg/kg	03/12/26	DM

All internal QC parameters were met. Unusual sample conditions, if any, are described. Surrogate Spike results designated with "D" indicate that the analyte was diluted out. "MI" indicates matrix interference. Concentration and *Reporting Limit (RL) based on areas provided by client. Values are reported to three significant figures. Solid PPM = mg/kg | PPB = µg/kg and Water PPM = mg/L | PPB = µg/L. The test results apply to the sample as received.

Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Washoe County School District (4991)
Address: 7495 S. Virginia Street
Reno, NV 89511

Attn:

Project:
Location: 106 Libby Booth ES
Number:

Order #: 676143

Matrix Paint
Received 03/11/26
Reported 03/13/26

PO Number: PO224939

Sample ID / Parameter	Cust. Sample ID	Location / Method	Result	RL*	Units	Analysis Date	Analyst
676143-041	106PB-6061-16749	S Side Cntr Playground S					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<13.3**	13.3	mg/kg	03/12/26	DM
676143-042	106PB-6061-16750	S Side Cntr Playground S					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<10.3**	10.2	mg/kg	03/12/26	DM
676143-043	106PB-6061-16751	Cntr Basketball Court					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.37**	9.37	mg/kg	03/12/26	DM
676143-044	106PB-6061-16752	N Basketball Court NE					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.23**	9.23	mg/kg	03/12/26	DM
676143-045	106PB-6061-16753	S Basketball Court N					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.48**	9.48	mg/kg	03/12/26	DM
676143-046	106PB-6061-16754	N Side Cntr Playground W					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<20.3**	20.3	mg/kg	03/12/26	DM
676143-047	106PB-6061-16755	N Side Cntr Playground W					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<20.2**	20.1	mg/kg	03/12/26	DM
676143-048	106PB-6061-16756	N Side Cntr Playground SE					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<10.2**	10.2	mg/kg	03/12/26	DM
676143-049	106PB-6061-16757	N Side Cntr Playground W					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.43**	9.42	mg/kg	03/12/26	DM
676143-050	106PB-6061-16758	N Side Cntr Playground					
Metals Analysis							
Lead		EPA 6010D / ME-003	**<9.48**	9.48	mg/kg	03/12/26	DM

All internal QC parameters were met. Unusual sample conditions, if any, are described. Surrogate Spike results designated with "D" indicate that the analyte was diluted out. "MI" indicates matrix interference. Concentration and *Reporting Limit (RL) based on areas provided by client. Values are reported to three significant figures. Solid PPM = mg/kg | PPB = µg/kg and Water PPM = mg/L | PPB = µg/L. The test results apply to the sample as received.

Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Washoe County School District (4991)
Address: 7495 S. Virginia Street
Reno, NV 89511

Attn:

Project:
Location: 106 Libby Booth ES
Number:

Order #: 676143

Matrix Paint
Received 03/11/26
Reported 03/13/26

PO Number: PO224939

Sample ID / Parameter	Cust. Sample ID / Method	Location	Result	RL*	Units	Analysis Date	Analyst
676143-051	106PB-6061-16759	N Side Cntr Playground					
Metals Analysis							
Lead	EPA 6010D / ME-003		**<9.78**	9.78	mg/kg	03/12/26	DM

676143-03/13/26 12:09 PM

Reviewed By: **Ahmed Elnasseh**
Analyst

State Certifications

Method	Parameter	Nevada	Virginia
EPA 6010D	Lead	Not Certified	VELAP Certified

State	Certificate Number
Virginia	VELAP 13789

All internal QC parameters were met. Unusual sample conditions, if any, are described. Surrogate Spike results designated with "D" indicate that the analyte was diluted out. "MI" indicates matrix interference. Concentration and *Reporting Limit (RL) based on areas provided by client. Values are reported to three significant figures. Solid PPM = mg/kg | PPB = µg/kg and Water PPM = mg/L | PPB = µg/L. The test results apply to the sample as received.

S 51

676143

V:\676\676143

ssmith 3/11/2026 12:52:12 PM

U.S. Mail N/A

WCSD LEAD BULK SAMPLE CHAIN OF CUSTODY

Requested By: John Nolan **Phone Number: 775-325-8491** **Fax Nu**

Analysis Turn Around Time: **Rush-Same Day,** **1 Day,** **2 Day,** **3 Day,** **5 Day**

Instructions: Email results to the ESA Department. In addition, produce a separate report for each facility. A new prefix number on a sample identifies a new site. ACCT. #4991

Analysis Type: ICP **Date Sampled: 3/2/2026** **Facility: 106 - Libby Booth ES**

SAMPLE #	ITEM DESCRIPTION	SUBSTRATE	COLOR	ROOM
106PB - 6061 - 16709	W Side Center Door Frame	Metal	Dark Navy	E3
106PB - 6061 - 16710	W Side Center Door	Metal	Dark Navy	E3
106PB - 6061 - 16711	E Side Center Door	Metal	Dark Navy	E3
106PB - 6061 - 16712	N Side Center @ Damage Floor	Epoxy	Grey Flecks	B1A
106PB - 6061 - 16713	SW Corner @ Damage Floor	Epoxy	Grey Flecks	B1A
106PB - 6061 - 16714	E Side N End @ Damage Floor	Epoxy	Grey Flecks	B1A
106PB - 6061 - 16715	S Side Center Wall	Drywall	Light Grey	B1
106PB - 6061 - 16716	NW Corner Wall	Drywall	Light Grey	B1

SENT BY: Brian Priest **DATE/TIME:** 3-6-26 11:20AM

RECEIVED BY: [signature] **DATE/TIME:** 3/11/26 1246

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

Charge to CC

WCSD LEAD BULK SAMPLE CHAIN OF CUSTODY FORM

Requested By: John Nolan **Phone Number: 775-325-8491** **Fax Number: 775-851-5662**

Analysis Turn Around Time: Rush-Same Day, 1 Day, 2 Day, 3 Day, 5 Day

Instructions: Email results to the ESA Department. In addition, produce a separate report for each facility. A new prefix number on a sample identifies a new site. ACCT. #4991

Analysis Type: ICP **Date Sampled: 3/2/2026** **Facility: 106 - Libby Booth ES**

SAMPLE #	ITEM DESCRIPTION	SUBSTRATE	COLOR	ROOM
106PB - 6061 - 16717	N Side Center Wall	Drywall	Light Grey	B1
106PB - 6061 - 16718	E Side Center @ Damage	Drywall	Light Grey	B1
106PB - 6061 - 16719	NW Corner Wall	CMU	Pastel Yellow	B1
106PB - 6061 - 16720	SW Corner Wall	CMU	Pastel Yellow	B1
106PB - 6061 - 16721	E Side N End Wall	Acoustic	White	10
106PB - 6061 - 16722	E Side N End Wall	Acoustic	White	6
106PB - 6061 - 16723	NE Corner Wall	Acoustic	White	10
106PB - 6061 - 16724	NE Corner Ceiling	FCP	White	10

SENT BY: Brian Priest **DATE/TIME:** 3-6-26 11:20 AM

RECEIVED BY: [signature] **DATE/TIME:** 3/11/26 1249

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

Charge to CC

WCSD LEAD BULK SAMPLE CHAIN OF CUSTODY FORM

Requested By: John Nolan **Phone Number: 775-325-8491** **Fax Number: 775-851-5662**

Analysis Turn Around Time: Rush-Same Day, 1 Day, 2 Day, (3 Day,) 5 Day

Instructions: Email results to the ESA Department. In addition, produce a separate report for each facility. A new prefix number on a sample identifies a new site. ACCT. #4991

Analysis Type: (ICP) **Date Sampled: 3/2/2026** **Facility: 106 - Libby Booth ES**

SAMPLE #	ITEM DESCRIPTION	SUBSTRATE	COLOR	ROOM
106PB - 6061 - 16725	SW Corner Ceiling	FCP	White	10
106PB - 6061 - 16726	S Side W End Ceiling	FCP	White	10
106PB - 6061 - 16727	NE Corner Wall	Drywall	White	7AEntry
106PB - 6061 - 16728	Space 9 Closet SE Corner Wall	Drywall	White	S9C
106PB - 6061 - 16729	SE Corner Wall	Drywall	White	7AEntry
106PB - 6061 - 16730	North Side Center Playground NW Corner Pole	Metal	Blue	NSCP
106PB - 6061 - 16731	North of Center Playground Sside Center Pole	Metal	Blue	NCP
106PB - 6061 - 16732	N Side Center Playground N Side Center Pole	Metal	Blue	NSCP

SENT BY: Brian Priest **DATE/TIME:** 3-6-26 11:20 AM

RECEIVED BY: [signature] **DATE/TIME:** 3/11/26 1249

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

Charge to CC

WCSD LEAD BULK SAMPLE CHAIN OF CUSTODY FORM

Requested By: John Nolan **Phone Number: 775-325-8491** **Fax Number: 775-851-5662**

Analysis Turn Around Time: Rush-Same Day, 1 Day, 2 Day, (3 Day), 5 Day

Instructions: Email results to the ESA Department. In addition, produce a separate report for each facility. A new prefix number on a sample identifies a new site. ACCT. #4991

Analysis Type: (ICP) **Date Sampled: 3/2/2026** **Facility: 106 - Libby Booth ES**

SAMPLE #	ITEM DESCRIPTION	SUBSTRATE	COLOR	ROOM
106PB - 6061 - 16733	S Side Center Playground SW of Center Beam	Metal	Brown	SSCP
106PB - 6061 - 16734	S Side Center Playground E side N End Beam	Metal	Brown	SSCP
106PB - 6061 - 16735	S Side Center Playground N Side W End Beam	Metal	Brown	SSCP
106PB - 6061 - 16736	N of Center Playground SE Corner Railing	Metal	Golden Yellow	NCP
106PB - 6061 - 16737	N of Center Playground NW Corner Railing	Metal	Golden Yellow	NCP
106PB - 6061 - 16738	N of Center Playground N Side W End Railing	Metal	Golden Yellow	NCP
106PB - 6061 - 16739	SW Awning SW Corner column	Metal	Grey Blue	SWA
106PB - 6061 - 16740	SW Awning NW Corner Column	Metal	Grey Blue	SWA

SENT BY: Brian Priest **DATE/TIME:** 3-6-26 11:20 AM

RECEIVED BY: [signature] **DATE/TIME:** 3/6/26 1249

RECEIVED BY: _____ **DATE/TIME:** _____

RECEIVED BY: _____ **DATE/TIME:** _____

Charge to CE

WCSD LEAD BULK SAMPLE CHAIN OF CUSTODY FORM

Requested By: John Nolan **Phone Number: 775-325-8491** **Fax Number: 775-851-5662**

Analysis Turn Around Time: Rush-Same Day, 1 Day, 2 Day, 3 Day, 5 Day

Instructions: Email results to the ESA Department. In addition, produce a separate report for each facility. A new prefix number on a sample identifies a new site. ACCT. #4991

Analysis Type: ICP **Date Sampled: 3/2/2026** **Facility: 106 - Libby Booth ES**

SAMPLE #	ITEM DESCRIPTION	SUBSTRATE	COLOR	ROOM
106PB - 6061 - 16741	SW Awning NE Corner Column	Metal	Grey Blue	SWA
106PB - 6061 - 16742	SW Playground E of Center Beam	Metal	Grey	SWP
106PB - 6061 - 16743	SW Playground W of Center Beam	Metal	Grey	SWP
106PB - 6061 - 16744	SW Playground S Side Center Beam	Metal	Grey	SWP
106PB - 6061 - 16745	N Side Center Playground W of Center Tunnel	Plastic	Orange	NSCP
106PB - 6061 - 16746	N Side Center Playground W of Center Tunnel	Plastic	Orange	NSCP
106PB - 6061 - 16747	N Side Center Playground W of Center Tunnel	Plastic	Orange	NSCP
106PB - 6061 - 16748	S Side Center Playground S Side W End Column	Metal	Tan	SSCP

SENT BY: Brian Priest **DATE/TIME:** 3-6-26 11:20 AM

RECEIVED BY: [signature] **DATE/TIME:** 3/11/26 1249

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

Charge to CE

WCSD LEAD BULK SAMPLE CHAIN OF CUSTODY FORM

Requested By: John Nolan **Phone Number: 775-325-8491** **Fax Number: 775-851-5662**

Analysis Turn Around Time: Rush-Same Day, 1 Day, 2 Day, (3 Day), 5 Day

Instructions: Email results to the ESA Department. In addition, produce a separate report for each facility. A new prefix number on a sample identifies a new site. ACCT. #4991

Analysis Type: (ICP) **Date Sampled: 3/2/2026** **Facility: 106 - Libby Booth ES**

SAMPLE #	ITEM DESCRIPTION	SUBSTRATE	COLOR	ROOM
106PB - 6061 - 16749	S Side Center Playground S Side Center Column	Metal	Tan	SSCP
106PB - 6061 - 16750	S Side Center Playground S Side W End Column	Metal	Tan	SSCP
106PB - 6061 - 16751	Center Basketball Court Center of Court	Asphalt	White	CBC
106PB - 6061 - 16752	North Basketball Court NE Corner Court	Asphalt	white	NBC
106PB - 6061 - 16753	South Basketball Court N Side W End Court	Asphalt	white	SBC
106PB - 6061 - 16754	N Side Center Playground W Side Center Pole	Metal	Yellow	NSCP
106PB - 6061 - 16755	N side Center Playground W Side Center Pole	Metal	Yellow	NSCP
106PB - 6061 - 16756	N Side Center Playground SE Corner Pole	Metal	Yellow	NSCP

SENT BY: Brian Priest **DATE/TIME:** 3-6-26 11:20 AM

RECEIVED BY: [signature] **DATE/TIME:** 3/11/26 1249

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

Charge to ea

WCSD LEAD BULK SAMPLE CHAIN OF CUSTODY FORM

Requested By: John Nolan **Phone Number: 775-325-8491** **Fax Number: 775-851-5662**

Analysis Turn Around Time: **Rush-Same Day, 1 Day, 2 Day, (3 Day), 5 Day**

Instructions: Email results to the ESA Department. In addition, produce a separate report for each facility. A new prefix number on a sample identifies a new site. ACCT. #4991

Analysis Type: (ICP) **Date Sampled: 3/2/2026** **Facility: 106 - Libby Booth ES**

SAMPLE #	ITEM DESCRIPTION	SUBSTRATE	COLOR	ROOM
106PB - 6061 - 16757	N Side Center Playground W Side Center Panel	Plastic	Yellow	NSCP
106PB - 6061 - 16758	N Side Center Playground Center panel	Plastic	Yellow	NSCP
106PB - 6061 - 16759	N Side Center Playground Center Panel	Plastic	Yellow	NSCP

SENT BY: Brian Priest **DATE/TIME:** 3-6-26 11:20 AM

RECEIVED BY: [signature] **DATE/TIME:** 3/6/26 12:49

RECEIVED BY: **DATE/TIME:**

RECEIVED BY: **DATE/TIME:**

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	02-19-2026
Address:	1450 Stewart St, Reno, NV 89502								**FACS Job #:**	PJ90910
Start Time:	1525	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	0.90	**Technician:**	Ryan Hettich
End Time:	1715	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	1.0	**Inspector/Assessor:**	Danny Prado
SciAps X-550Pb SN: 03539		**Results in red are lead-based paints or coatings.**							**Condition Codes: I = Intact, F = Fair, P = Poor**	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
1.	Space 6 N Side Center	Light Blue	CMU	Wall	I	0.2
2.	Space 6 NW Corner	Light Blue	Metal	Door Frame	I	0.7
3.	Space 6 W Side N End	Light Blue	Metal	Door	I	0.8
4.	Space 6 W of Center	White	ACT	Ceiling Tile	I	0.0
5.	Space 6 S Side Center	White	ACT	Ceiling Tile	I	0.0
6.	Space 6 S Side Center	White	Wood	Ceiling Trim	I	0.7
7.	Space 6 NE Corner	White	ACT	Ceiling Tile	I	0.0
8.	Space 6R S Side Center	White	Drywall	Wall	I	0.0
9.	Space 6R SE Corner	White	Drywall	Wall	I	0.0
10.	Space 6R SW Corner	White	Drywall	Wall	I	0.0
11.	Space 6R S Side Center	White	FCP	Wall	I	0.0
12.	Space 6R SE Corner	White	FCP	Wall	I	0.0
13.	Space 6R SW Corner	White	FCP	Wall	I	0.0
14.	Space 6R E Side Center	White	CMU	Wall	I	0.0
15.	Space 6R N Side Center	White	CMU	Wall	I	0.0
16.	Space 6R W Side Center	White	CMU	Wall	I	0.0
17.	Space 6R NE Corner	White	Metal	Door Frame	I	0.3
18.	Space 6R SE Corner	White	Porcelain	Toilet	I	4.4
19.	Space 6R S Side W End	White	Porcelain	Sink	I	0.0
20.	Space 6R S Side W End	White	Porcelain	Sink	I	0.0

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	02-19-2026
Address:	1450 Stewart St, Reno, NV 89502								**FACS Job #:**	PJ90910
Start Time:	1525	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	0.90	**Technician:**	Ryan Hettich
End Time:	1715	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	1.0	**Inspector/Assessor:**	Danny Prado
SciAps X-550Pb SN: 03539		**Results in red are lead-based paints or coatings.**								**Condition Codes: I = Intact, F = Fair, P = Poor**

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
21.	Space 7A E Side Center	Light Blue	Metal	Unit	I	0.0
22.	Space 7A SE Corner	Light Blue	Metal	Unit	I	0.0
23.	Space 7A E Side Center	Light Blue	Metal	Unit	I	0.0
24.	Space 7A E Side Center	Light Blue	CMU	Wall	I	0.2
25.	Space 7A N Side W End	Light Blue	Metal	Door Frame	I	0.1
26.	Space 7A NE Corner	White	ACT	Ceiling	I	0.0
27.	Space 7A NE Corner	Light Blue	Wood	Ceiling Trim	I	0.7
28.	Space 7A S Side W End	Brown	Metal	Door Frame	I	0.2
29.	Space 7A Entry E Side Center	White	Drywall	Wall	I	0.0
30.	Space 7A Entry N Side W End	White	Drywall	Wall	I	0.0
31.	Space 7A Entry NW Corner	White	CMU	Wall	I	0.1
32.	Space 7A Entry NW Corner	White	Wood	Door Frame	I	0.8
33.	Space 9 N Side Center	Black	CMU	Wall	I	0.0
34.	Space 9 N Side Center	White	CMU	Wall	I	0.0
35.	Space 9 S Side Center	Black	CMU	Wall	I	0.0
36.	Space 9 S Side Center	White	CMU	Wall	I	0.0
37.	Space 9 W Side N End	Black	Metal	Unit	I	0.2
38.	Space 9 SW Corner	Black	CMU	Wall	I	0.0
39.	Space 9 SW Corner	White	CMU	Wall	I	0.0
40.	Space 9 W Side S End	Blue	CMU	Wall	I	0.0

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	02-19-2026
Address:	1450 Stewart St, Reno, NV 89502								**FACS Job #:**	PJ90910
Start Time:	1525	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	0.90	**Technician:**	Ryan Hettich
End Time:	1715	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	1.0	**Inspector/Assessor:**	Danny Prado
SciAps X-550Pb SN: 03539		**Results in red are lead-based paints or coatings.**								**Condition Codes: I = Intact, F = Fair, P = Poor**

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
41.	Space 9 NW Corner	Blue	CMU	Wall	I	0.0
42.	Space 9 NW Corner	Blue	CMU	Wall	I	0.0
43.	Space 9 NW Corner	White	Metal	Door Frame	I	0.4
44.	Space 9 N Side W End	White	Wood	Door	I	0.6
45.	Space 9 E Side Center	Blue	CMU	Wall	I	0.0
46.	Space 9 Closet S Side Center	White	Drywall	Wall	I	0.0
47.	Space 9 Closet SE Corner	White	Drywall	Wall	I	0.0
48.	Space 9 Closet SW Corner	White	Drywall	Wall	I	0.0
49.	Space 9 Closet E Side Center	White	CMU	Wall	I	0.0
50.	Space 9 Closet NE Corner	White	CMU	Wall	I	0.0
51.	Space 9 Closet N Side Center	White	CMU	Wall	I	0.0
52.	Space 10 S Side Center	White	CMU	Wall	I	0.0
53.	Space 10 S Side Center	White	Acoustic	Wall	I	0.0
54.	Space 10 S Side Center	White	Metal	Unit	I	0.0
55.	Space 10 S Side E End	White	Metal	Vent	I	0.0
56.	Space 10 S Side E End	White	Acoustic	Wall	I	0.0
57.	Space 10 S Side E End	White	Acoustic	Wall	I	0.0
58.	Space 10 SE Corner	White	Acoustic	Wall	I	0.0
59.	Space 10 SE Corner	White	CMU	Wall	I	0.0
60.	Space 10 E Side S End	White	Porcelain	Drinking Fountain	I	0.0
61.	Space 10 E Side S End	White	Porcelain	Drinking Fountain	I	0.0

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	02-19-2026
Address:	1450 Stewart St, Reno, NV 89502								**FACS Job #:**	PJ90910
Start Time:	1525	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	0.90	**Technician:**	Ryan Hettich
End Time:	1715	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	1.0	**Inspector/Assessor:**	Danny Prado
SciAps X-550Pb SN: 03539		**Results in red are lead-based paints or coatings.**								**Condition Codes: I = Intact, F = Fair, P = Poor**

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
62.	Space 10 E Side S End	White	Porcelain	Drinking Fountain	I	0.0
63.	Space 10 E Side S End	White	Porcelain	Drinking Fountain	1	0.0
64.	Space 10 E Side S End	White	CMU	Wall	I	0.0
65.	Space 10 E Side Center	White	Wood	Door	I	0.5
66.	Space 10 E Side Center	White	Wood	Door Frame	I	0.2
67.	Space 10 E Side N End	White	Wood	Window Frame	I	0.6
68.	Space 10 NE Corner	White	CMU	Wall	I	0.0
69.	Space 10 NE Corner	Orange	CMU	Wall	I	0.0
70.	Space 10 NE Corner	Lime Green	CMU	Wall	I	0.0
71.	Space 10 N Side Center	Lime Green	Drywall	Wall	I	0.0
72.	Space 10 N Side W End	Orange	Drywall	Wall	I	0.0
73.	Space 10 N Side Center	Orange	CMU	Wall	I	0.0
74.	Space 10 N Side W End	Lime Green	CMU	Wall	I	0.0
75.	Space 10 NW Corner	Orange	Concrete	Wall	I	0.0
76.	Space 10 NW Corner	Orange	Concrete	Wall	I	0.0
77.	Space 10 NW Corner	Orange	Concrete	Wall	I	0.0
78.	Space 10 NW Corner	Lime Green	Concrete	Wall	I	0.0
79.	Space 10 NW Corner	Lime Green	Concrete	Wall	I	0.0
80.	Space 10 NW Corner	Lime Green	Concrete	Wall	I	0.0

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	02-19-2026
Address:	1450 Stewart St, Reno, NV 89502								**FACS Job #:**	PJ90910
Start Time:	1525	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	0.90	**Technician:**	Ryan Hettich
End Time:	1715	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	1.0	**Inspector/Assessor:**	Danny Prado
SciAps X-550Pb SN: 03539		**Results in red are lead-based paints or coatings.**								**Condition Codes: I = Intact, F = Fair, P = Poor**

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
81.	Space 10 NW Corner	Lime Green	Metal	Door Frame	I	0.1
82.	Space 10 NW Corner	Orange	Metal	Door	I	0.0
83.	Space 10 NW Corner	Orange	Metal	Door	I	0.0
84.	Space 10 NW Corner	Orange	Metal	Door	I	0.0
85.	Space 10 W Side N End	White	Metal	Panel	I	0.0
86.	Space 10 SW Corner	Orange	Metal	Door	I	0.0
87.	Space 10 SW Corner	Lime Green	Metal	Door	I	0.3
88.	Space 11 E Side Center	White	FRP	Wall	I	0.0
89.	Space 11 E Side Center	White	Drywall	Ceiling	I	0.0
90.	Space 11 W Side Center	White	Drywall	Ceiling	I	0.0
91.	Space 11 N Side Center	White	Drywall	Ceiling	I	0.0
92.	Space 11 SE Corner	White	Porcelain	Sink	I	0.0
93.	Space 11 NW Corner	White	Porcelain	Toilet	I	0.0
94.	Space 11 SW Corner	White	Metal	Door Frame	I	0.0
95.	Space 11 SW Corner	White	Metal	Door Frame	I	0.0
96.	Space 11 SW Corner	White	Metal	Door Frame	I	0.0
97.	Space 12 SW Corner	White	Metal	Door Frame	I	0.0
98.	Space 12 SW Corner	White	Drywall	Wall	I	0.0
99.	Space 12 NE Corner	White	Porcelain	Toilet	I	0.0
100	Space 12 W Side S End	White	Porcelain	Sink	I	0.0
101	Space B1 SE Corner	Blue	Metal	Door Frame	I	0.0

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	02-19-2026
Address:	1450 Stewart St, Reno, NV 89502								**FACS Job #:**	PJ90910
Start Time:	1525	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	0.90	**Technician:**	Ryan Hettich
End Time:	1715	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	1.0	**Inspector/Assessor:**	Danny Prado
SciAps X-550Pb SN: 03539		**Results in red are lead-based paints or coatings.**								**Condition Codes: I = Intact, F = Fair, P = Poor**

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
102	Space B1 SE Corner	Blue	Metal	Door Frame	I	0.0
103	Space B1 SE Corner	Blue	Metal	Door Frame	I	0.2
104	Space B1 SE Corner	White	Metal	Door Frame	I	0.4
105	Space B1 SE Corner	White	Metal	Door	I	0.0
106	Space B1 SE Corner	White	Metal	Door	I	0.0
107	Space B1 SE Corner	White	Metal	Door	I	0.0
108	Space B1 SE Corner	Light Gray	Drywall	Wall	I	0.0
109	Space B1 S Side Center	Light Gray	Drywall	Wall	I	0.0
110	Space B1 SW Corner	Light Gray	Drywall	Wall	I	0.0
111	Space B1 SW Corner	Pastel Yellow	CMU	Wall	I	0.0
112	Space B1 W Side N End	Pastel Yellow	CMU	Wall	I	0.0
113	Space B1 NW Corner	Pastel Yellow	CMU	Wall	I	0.0
114	Space B1 NW Corner	Light Gray	Metal	Door Frame	I	0.6
115	Space B1 NW Corner	Light Gray	Drywall	Wall	I	0.0
116	Space B1 N Side E End	Light Gray	Metal	Door Frame	I	0.0
117	Space B1 N Side Center	Light Gray	CMU	Wall	I	0.0
118	Space B1 NE Corner	Pastel Yellow	CMU	Wall	I	0.0
119	Space B1 NE Corner	Pastel Yellow	Drywall	Wall	I	0.0
120	Space B1 E Side Center	Pastel Yellow	Drywall	Wall	I	0.0
121	Space B1 SE Corner	Pastel Yellow	Drywall	Wall	I	0.0

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	02-19-2026
Address:	1450 Stewart St, Reno, NV 89502								**FACS Job #:**	PJ90910
Start Time:	1525	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	0.90	**Technician:**	Ryan Hettich
End Time:	1715	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	1.0	**Inspector/Assessor:**	Danny Prado
SciAps X-550Pb SN: 03539		**Results in red are lead-based paints or coatings.**								**Condition Codes: I = Intact, F = Fair, P = Poor**

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
122	Space B1 S Side Center	White	Metal	Ceiling	I	0.0
123	Space B1 S Side Center	White	Wood	Ceiling Trim	I	0.0
124	Space B1 S Side E End	White	Metal	Ceiling Panel	I	0.1
125	Space B1 S Side E End	White	Wood	Ceiling Trim	I	0.0
126	Space B1 S Side W End	White	Wood	Ceiling Trim	I	0.0
127	Space B1 NW Corner	White	Metal	Vent	I	0.0
128	B1 Bathroom E Side Center	White	Drywall	Wall	I	0.0
129	B1 Bathroom SE Corner	White	Drywall	Wall	I	0.0
130	B1 Bathroom NE Corner	White	Drywall	Wall	I	0.0
131	B1 Bathroom N Side Center	White	CMU	Wall	I	0.0
132	B1 Bathroom W Side Center	White	CMU	Wall	I	0.0
133	B1 Bathroom NE Corner	White	Metal	Door Frame	I	0.0
134	B1 Bathroom NE Corner	White	Metal	Door Frame	I	0.0
135	B1 Bathroom NE Corner	White	Metal	Door Frame	I	0.1
136	Space B1A S Side E End	White	Drywall	Wall	I	0.0
137	Space B1A S Side E End	White	Drywall	Wall	I	0.0
138	Space B1A S Side E End	White	Drywall	Wall	I	0.0
139	Space B1A SW Corner	White	CMU	Wall	I	0.0
140	Space B1A SW Corner	White	Metal	Door Frame	I	0.6
141	Space B1A NE Corner	White	Metal	Vent	I	0.0

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	02-19-2026
Address:	1450 Stewart St, Reno, NV 89502								**FACS Job #:**	PJ90910
Start Time:	1525	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	0.90	**Technician:**	Ryan Hettich
End Time:	1715	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	1.0	**Inspector/Assessor:**	Danny Prado
SciAps X-550Pb SN: 03539		**Results in red are lead-based paints or coatings.**								**Condition Codes: I = Intact, F = Fair, P = Poor**

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
142	Space B1A NE Corner	Gray	Epoxy	Floor	I	0.0
143	Space B1A Center of Space	Gray	Epoxy	Floor	I	0.0
144	Space B1A W Side Center	Gray	Epoxy	Floor	I	0.0
145	Space B10 NE Corner	White	Metal	Vent	I	0.0
146	Space B10 NE Corner	White	Metal	Door	I	0.0
147	Space B10 NE Corner	White	Metal	Door Frame	I	0.2
148	Space B11 SW Corner	White	Wood	Ceiling Trim	I	0.0
149	Space B11 E of Center	White	Metal	Vent	I	0.0
150	Space B11 NE Corner	White	Wood	Door	I	0.0
151	Space B11 NE Corner	White	Wood	Door	I	0.0
152	Space B11 NE Corner	White	Wood	Door	I	0.0
153	Space B11 SE Corner	White	Metal	Door Frame	I	0.1
154	Space B11 SE Corner	White	Metal	Door	I	0.0
155	Space B11 SE Corner	White	Metal	Door	I	0.0
156	Space B11 SE Corner	White	Metal	Door	I	0.0
157	Space E3 E Side Center	Black	Metal	Door Frame	I	0.0
158	Space E3 NE Corner	Black	Metal	Door Frame	I	0.0
159	Space E3 NE Corner	Black	Metal	Door Frame	I	0.0
160	Space E3 NE Corner	Black	Metal	Door	I	0.0
161	Space E3 NE Corner	Black	Metal	Door	I	0.0

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	02-19-2026
Address:	1450 Stewart St, Reno, NV 89502								**FACS Job #:**	PJ90910
Start Time:	1525	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	0.90	**Technician:**	Ryan Hettich
End Time:	1715	**Calibration:**	**1.04 =**	0.90	**1.04 =**	1.0	**1.04 =**	1.0	**Inspector/Assessor:**	Danny Prado
SciAps X-550Pb SN: 03539		**Results in red are lead-based paints or coatings.**								**Condition Codes: I = Intact, F = Fair, P = Poor**

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
162	Space E3 NE Corner	Black	Metal	Door	I	0.0
163	Space E3 N Side W End	White	FCP	Ceiling	I	0.0
164	Space E3 N Side Center	White	FCP	Ceiling	I	0.0
165	Space E3 NW Corner	White	FCP	Ceiling	I	0.0
166	Space E3 N Side W End	White	Metal	T-Grid	I	0.0
167	Space E3 N Side Center	White	Metal	T-Grid	I	0.0
168	Space E3 NW Corner	White	Metal	T-Grid	I	0.0

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SURVEY FOR LEAD BASED PAINT

Site Name:	Booth Elementary School								**Date:**	2-27-26
Address:	1450 Stewart Street Reno, NV 89502								**FACS Job #:**	PJ90910
Calibration (1.03±0.02):	**Reading 1**	**1.0**	**Reading 2**	**1.0**	**Reading 3**	**0.90**	**Average=**	**0.90**	**Technician:**	Ryan Hettich
Calibration (1.03±0.02):	**Reading 1**	**0.90**	**Reading 2**	**1.0**	**Reading 3**	**1.0**	**Average=**	**0.90**	**Inspector/Assessor:**	Daniel Prado

Start Time:	**1220**	**SciAps X-550Pb |** S/N 03539	**Results in red are lead-based paints or coatings.**	**Condition Codes: I = Intact, F = Fair, P = Poor**
End Time:	**1325**			

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm^2)
1.	S Side Center Playground S Side Center	Tan	Metal	Column	I	0.0
2.	S Side Center Playground E Side Center	Tan	Metal	Column	I	0.0
3.	S Side Center Playground W Side Center	Tan	Metal	Column	I	0.0
4.	S Side Center Playground S Side Center	Brown	Metal	Beam	I	0.0
5.	S Side Center Playground E Side Center	Brown	Metal	Beam	I	0.0
6.	S Side Center Playground W Side Center	Brown	Metal	Beam	I	0.0
7.	SW Playground E Side Center	White	Metal	Beam	I	0.0
8.	SW Playground NW Corner	White	Metal	Beam	I	0.0
9.	SW Playground SW Corner	White	Metal	Beam	I	0.0
10.	S Court Center of Court	White	Asphalt	BB Court	I	0.0
11.	Center Court Center of Court	White	Asphalt	BB Court	I	0.0
12.	N Court Center of Court	White	Asphalt	BB Court	I	0.0
13.	N Side Center Playground W Side Center	Blue	Metal	Column	I	0.0
14.	N Side Center Playground SW Corner	Blue	Metal	Column	I	0.0
15.	N Side Center Playground E Side W End	Blue	Metal	Column	I	0.0
16.	N of Center Playground N Side Center	Blue	Metal	Column	I	0.0
17.	N Side Center Playground S Side Center	Yellow	Metal	Rails	I	0.0
18.	N Side Center Playground SE Corner	Yellow	Metal	Rails	I	0.0
19.	N Side Center Playground SW Corner	Yellow	Metal	Rails	I	0.0
20.	N Side Center Playground W of Center	Yellow	Plastic	Panel	I	0.0

FACS 35
Forensic Analytical Consulting Services
CELEBRATING 35 YEARS OF EXCELLENCE · 1986-2021

SURVEY FOR LEAD BASED PAINT

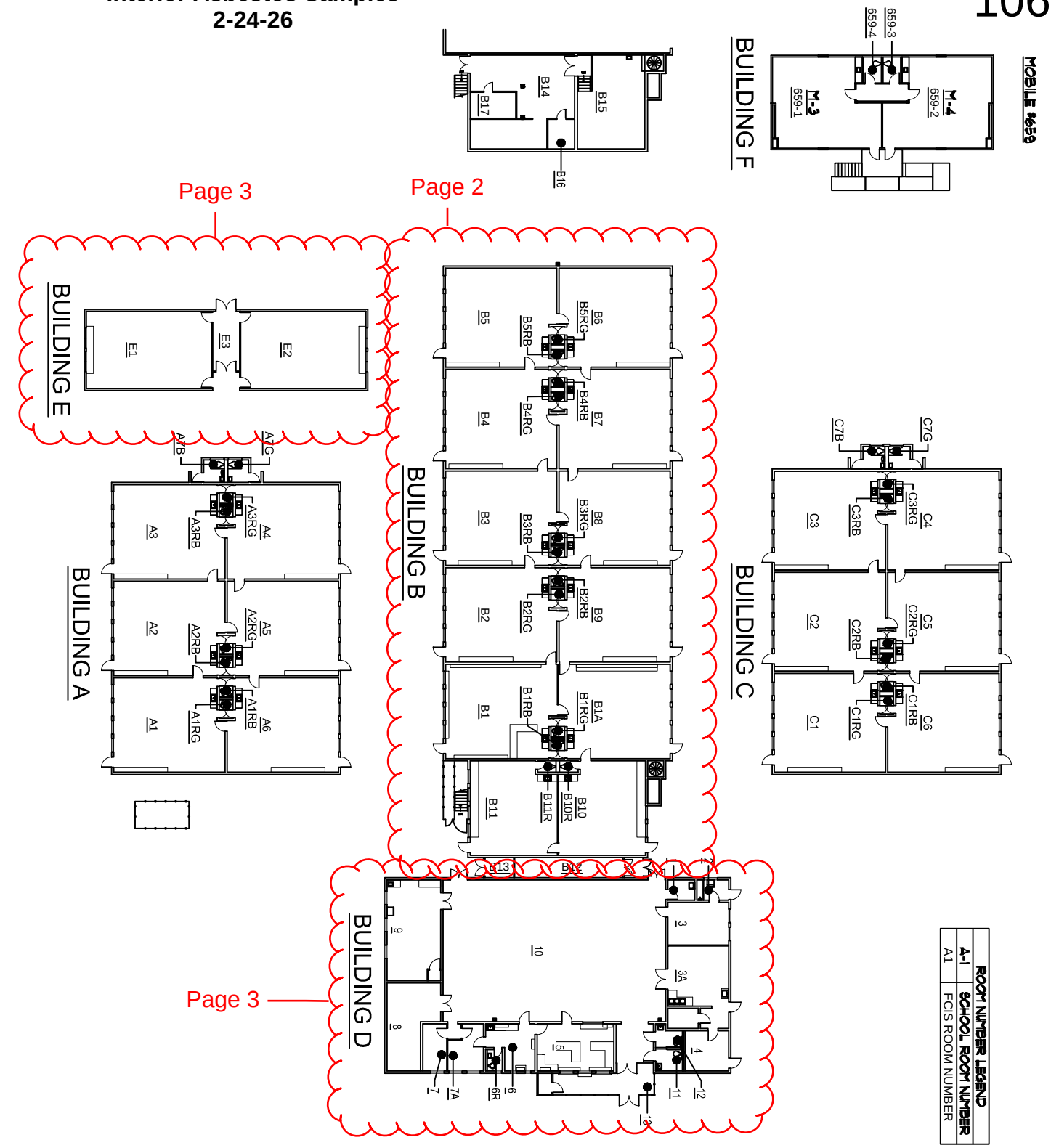
Site Name:	Booth Elementary School								**Date:**	2-27-26
Address:	1450 Stewart Street Reno, NV 89502								**FACS Job #:**	PJ90910
Calibration (1.03±0.02):	**Reading 1**	**1.0**	**Reading 2**	**1.0**	**Reading 3**	**0.90**	**Average=**	**0.90**	**Technician:**	Ryan Hettich
Calibration (1.03±0.02):	**Reading 1**	**0.90**	**Reading 2**	**1.0**	**Reading 3**	**1.0**	**Average=**	**0.90**	**Inspector/Assessor:**	Daniel Prado
Start Time:	**1220**	**SciAps X-550Pb |** S/N 03539		**Results in red are lead-based paints or coatings.**					**Condition Codes:**	
End Time:	**1325**								**I = Intact, F = Fair, P = Poor**	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm^2)
21.	N Side Center Playground W of Center	Yellow	Plastic	Panel	I	0.0
22.	N Side Center Playground W of Center	Yellow	Plastic	Panel	I	0.0
23.	N Side Center Playground W of Center	Orange	Plastic	Tube	I	0.0
24.	N Side Center Playground W of Center	Orange	Plastic	Tube	I	0.0
25.	N Side Center Playground W of Center	Orange	Plastic	Tube	I	0.0
26.	N of Center Playground N Side Center	Golden Yellow	Metal	Rail	I	0.0
27.	N of Center Playground Center of Structure	Golden Yellow	Metal	Rail	I	0.0
28.	N of Center Playground S Side Center	Golden Yellow	Metal	Rail	I	0.0
29.	SW Awning NE Corner	Grey/Blue	Metal	Column	I	0.0
30.	SW Awning NW Corner	Grey/Blue	Metal	Column	I	0.0
31.	SW Awning SE Corner	Grey/Blue	Metal	Column	I	0.0
32.						
33.						
34.						
35.						
36.						
37.						
38.						
39.						
40.						

Appendix C
Sample Location Drawing

Site Modernization - Project Specific Survey & Sampling
Interior Asbestos Samples
2-24-26

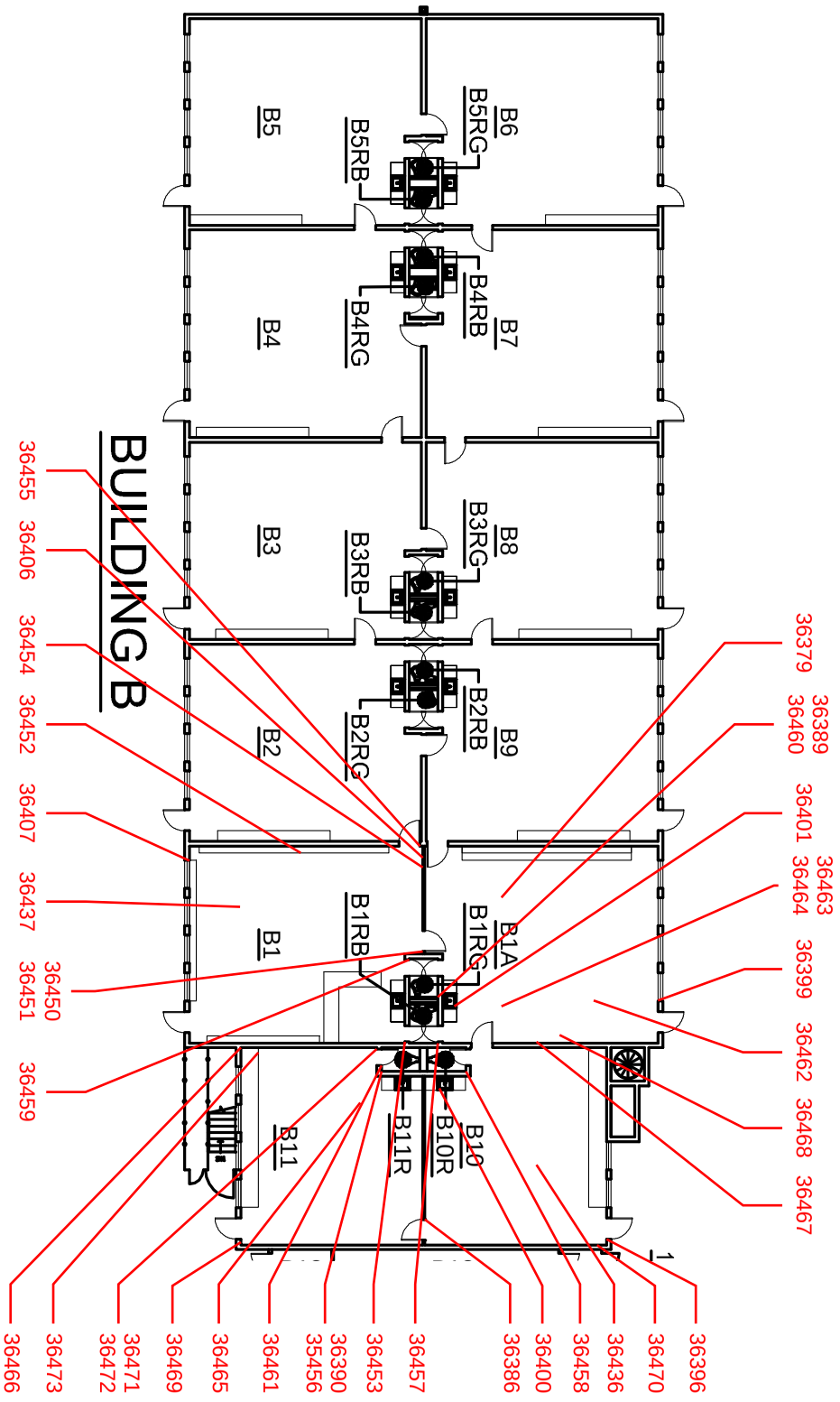
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LIBBY BOOTH ELEMENTARY - FCIS ROOM NUMBER REFERENCE FLOOR PLAN

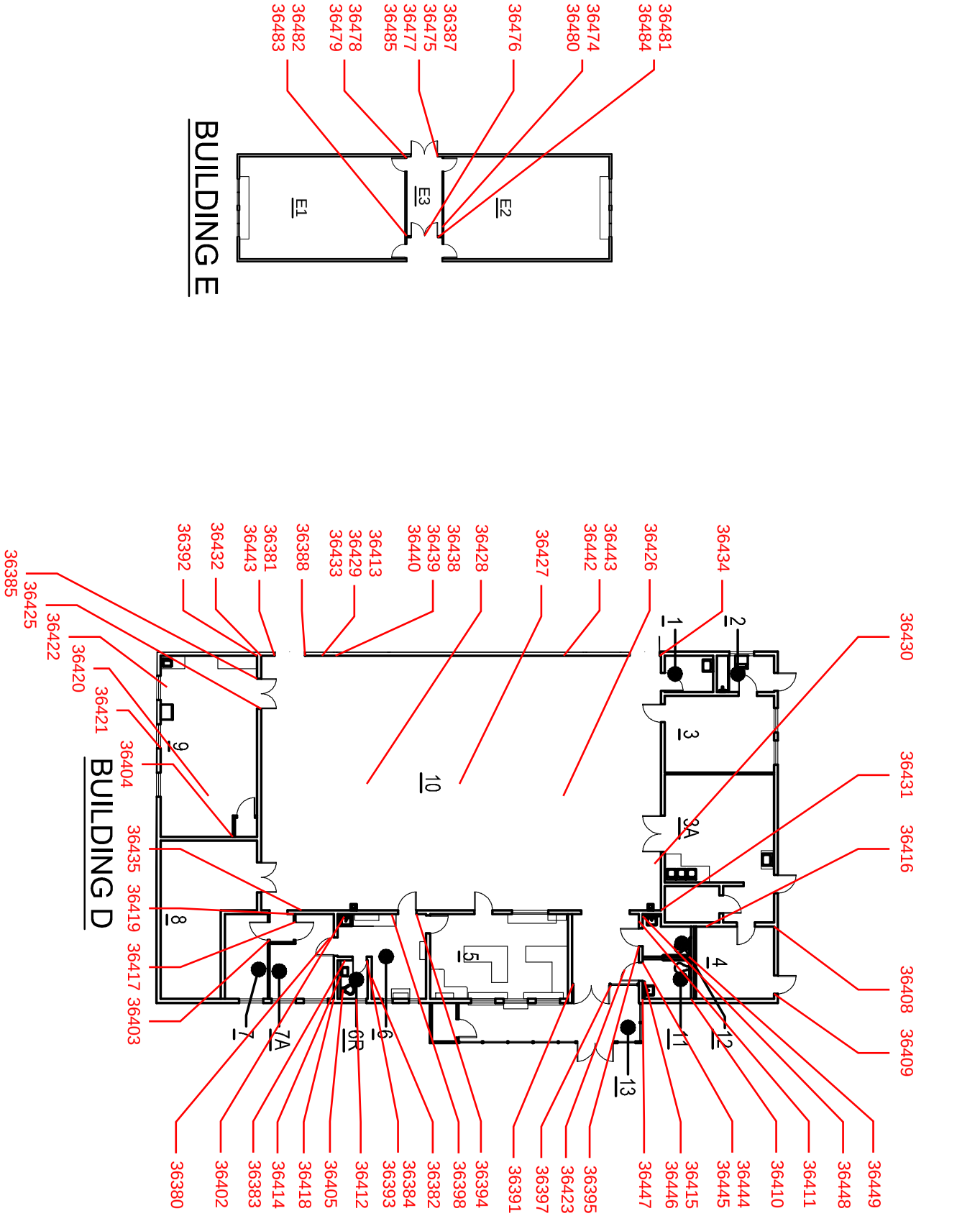
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LIBBY BOOTH ELEMENTARY - FCIS ROOM NUMBER REFERENCE FLOOR PLAN

N.T.S.



LIBBY BOOTH ELEMENTARY - FCIS ROOM NUMBER REFERENCE FLOOR PLAN

N.T.S.

106-Libby C. Booth Elementary School

BTA BUILDING TECHNOLOGY ASSOCIATES

36487

North Side Center Playground

36494

36486

North Basketball Court

North of Center Playground

36492

36493

Center Basketball Court

SD1

P-659

PORTABLE NO. 659

C1

C-4 C-5 C-6 C C-3 C-2A C-2 C-1 C-B C-A

B2

P-727

PORTABLE NO. 727

B-6 B-7 B-8 B B-9 LIBRARY K-1 KINDER B-5 B-4 B-3 B-2 LIBRARY K-2 KINDER

ST. CUST. PRIN. KITCHEN FRZ. CLASS MULTIPURPOSE D OFF D1 NURSE OFF OFF LOUNGE WORK

South Basketball Court

36490

36489

SW Awning

36488

36491

E

A1

A-4 A-5 A A-6 A-3 A-2 A-1 A-C A-B

B1

SW Playground

South Side Center Playground

N W E S

Date: September 25, 2024

106-Libby C. Booth Elementary School

North Side Center Playground

North of Center Playground

North Basketball Court

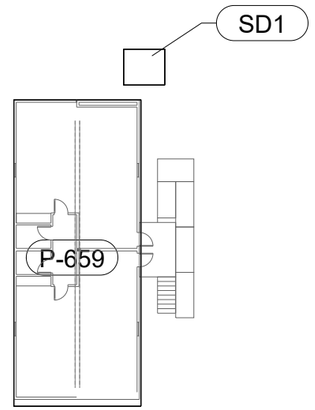
Center Basketball Court

South Basketball Court

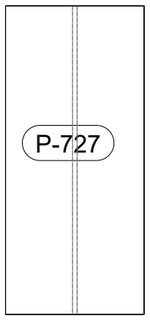
SW Playground

South Side Center Playground

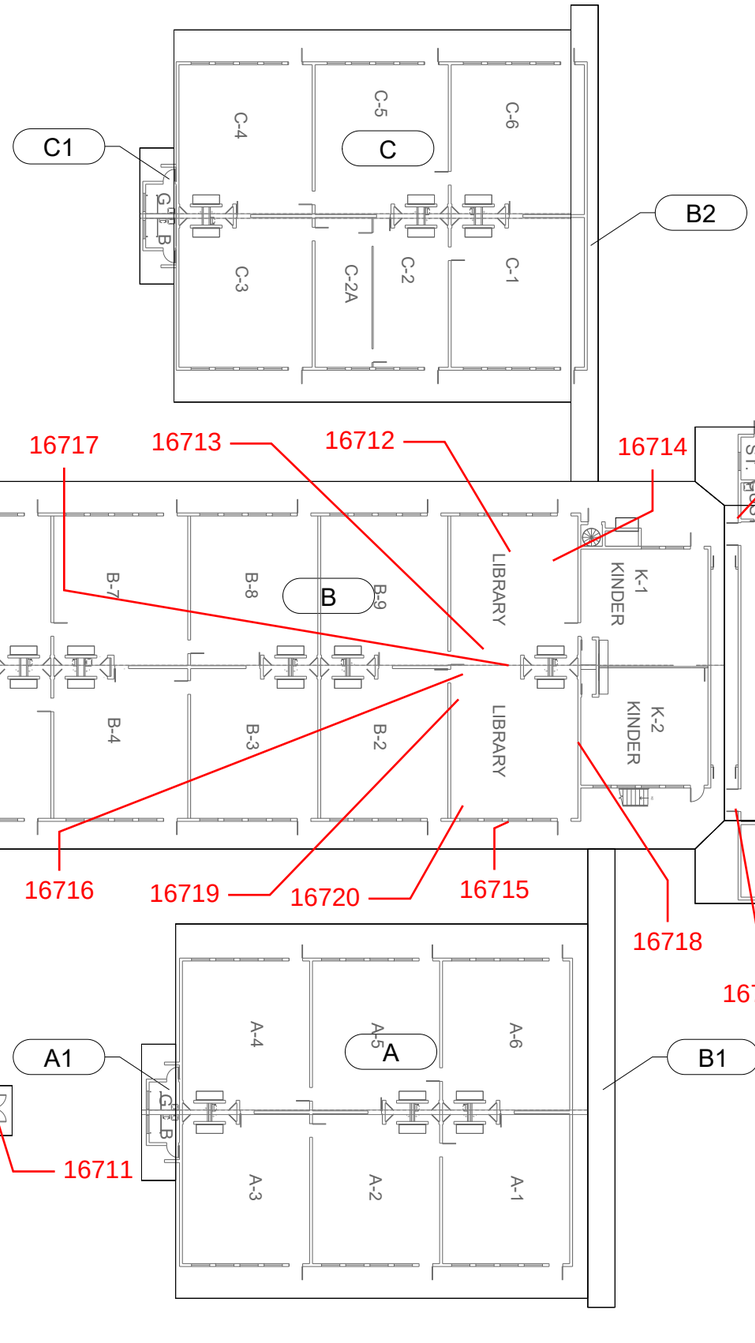
SW Awning



PORTABLE NO. 659



PORTABLE NO. 727



N

W E

S

Date: September 25, 2024

106-Libby C. Booth Elementary School

BTA BUILDING TECHNOLOGY ASSOCIATES

16730
16732
16755
North Side Center Playground
16758
16759
16754
16737
16756
North of Center Playground
16738
16731
16736
North Basketball Court
16752
Center Basketball Court
16751
16757
16745
16746
16747
16753
South Basketball Court

SD1
P-659
PORTABLE NO. 659

P-727
PORTABLE NO. 727

16741
16740
SW Awning
16739

16743
16742
SW Playground
16744
16735
16734
South Side Center Playground
16733
16748
16750
16749

C1
C
C-4
C-5
C-6
C-3
C-2A
C-2
C-1
B2

B
B-6
B-7
B-8
B-9
B-5
B-4
B-3
B-2
LIBRARY
K-1 KINDER
K-2 KINDER

D
D1
ST. CUST
PRIN.
KITCHEN
FRZ.
CLASS
MULTIPURPOSE
NURSE
OFF
OFF
LOUNGE
WORK

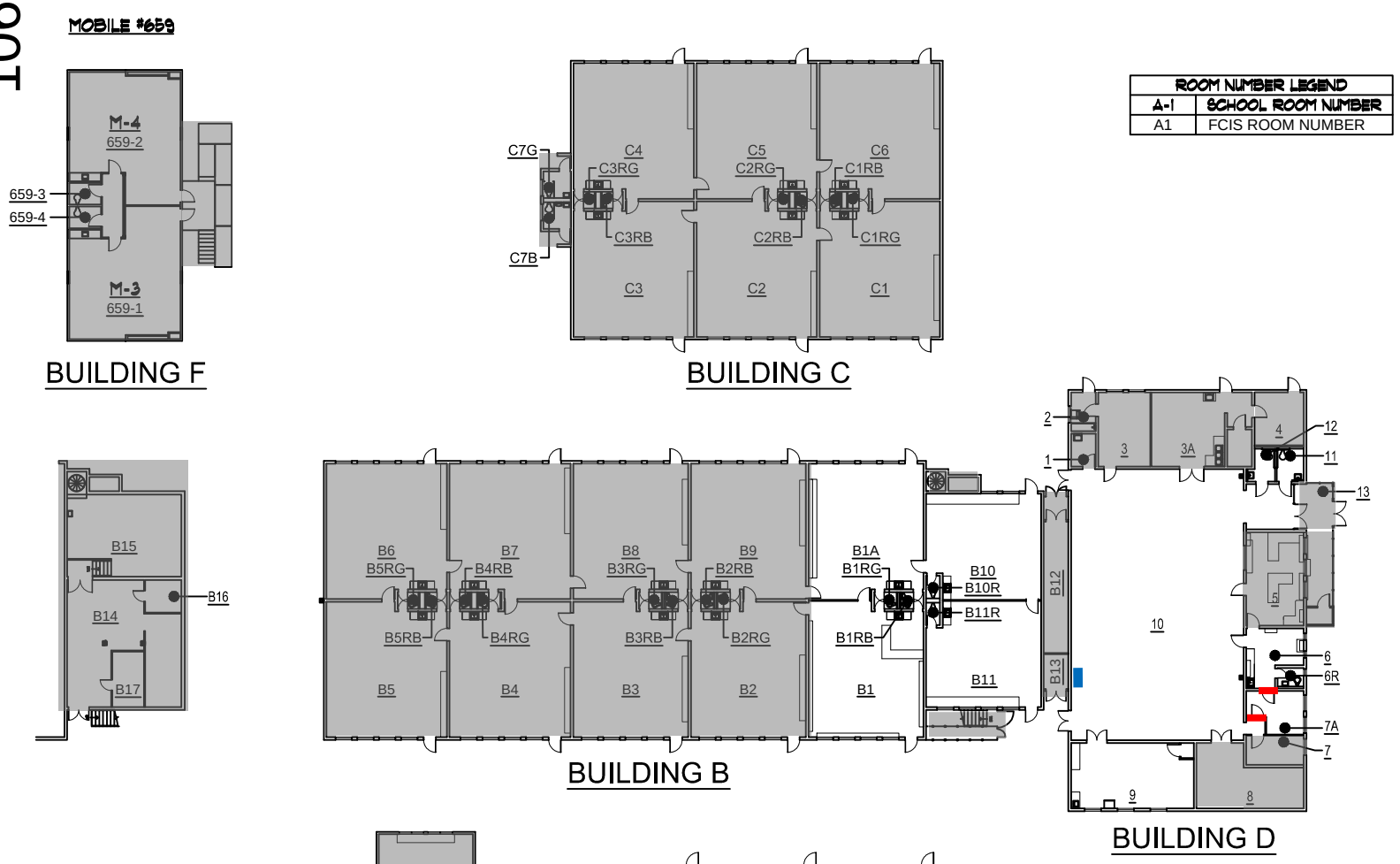
E
A1
A
A-4
A-5
A-6
A-3
A-2
A-1
B1

N
W
E
S

Date: September 25, 2024

Appendix D
Asbestos Location Drawings

106



MAP KEY

- ACM Cementitious Panels
- Fire Door - 20 Minute Rating
- Areas Not Sampled

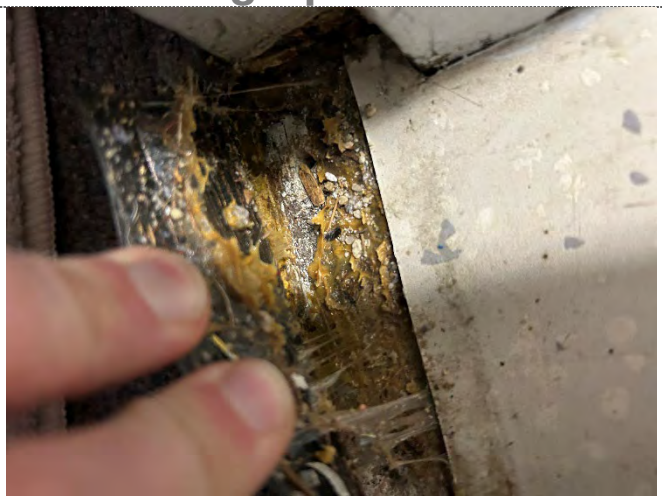
LIBBY BOOTH ELEMENTARY - FCIS ROOM NUMBER REFERENCE FLOOR PLAN

N.T.S.

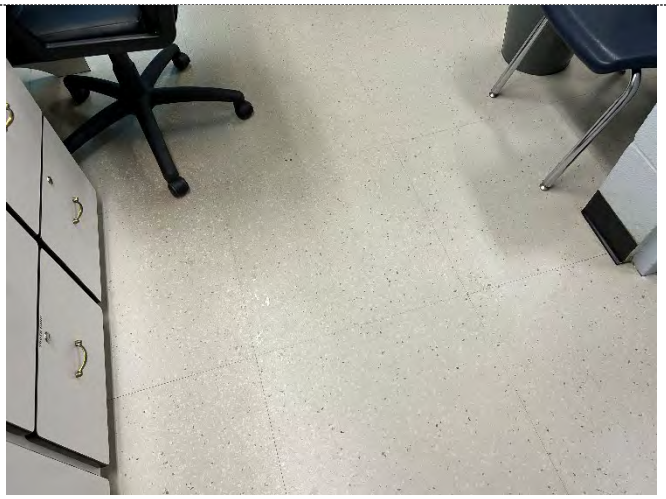
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Appendix E

Site Photographs



Concrete



VFT & Mastic – 24” Light Grey Speckled



Baseboard & Mastic – 4” Black



CMU & Grout



ACT & Glue – 12” Random Hole



Doorframe Sealant



Window Sealant – Grey



Sink Coating – Black



Drywall – Stipple Texture



FRP & Glue



Baseboard & Mastic – 6” Black



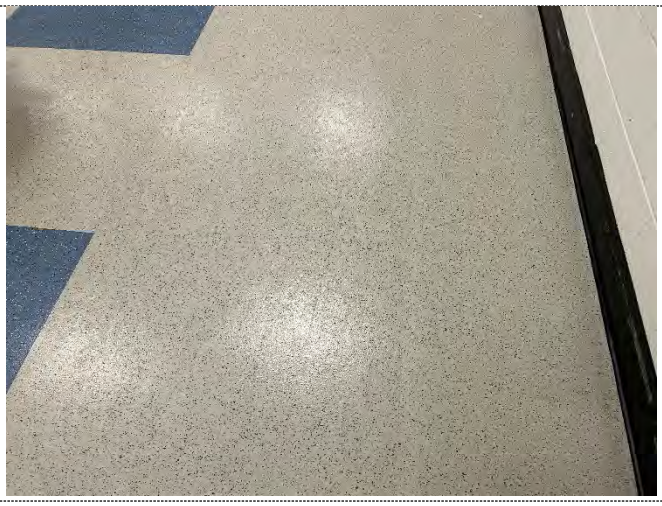
Restroom Sealant – White



Carpet & Mastic – Red Multi



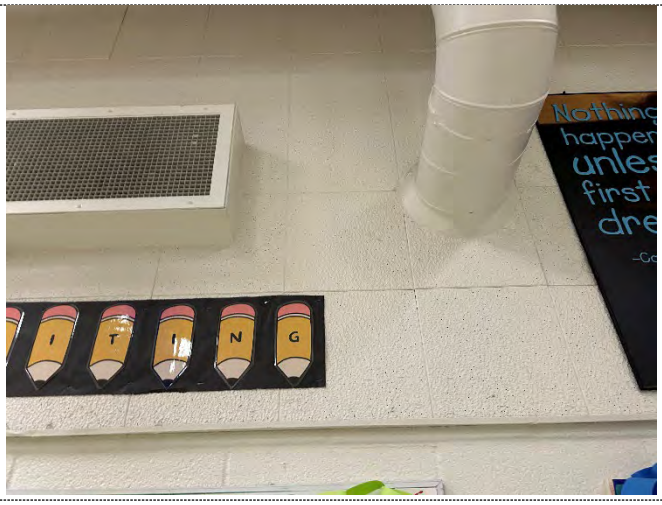
Carpet & Mastic – Blue Multi



VSF & Glue – Light Grey Specks



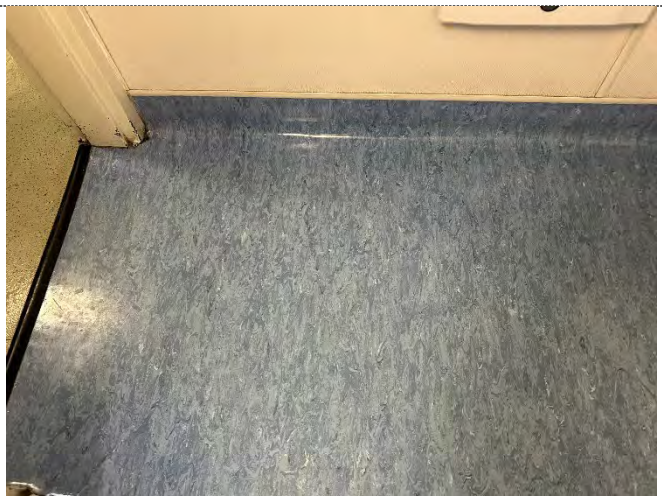
VSF & Glue – Blue Specks

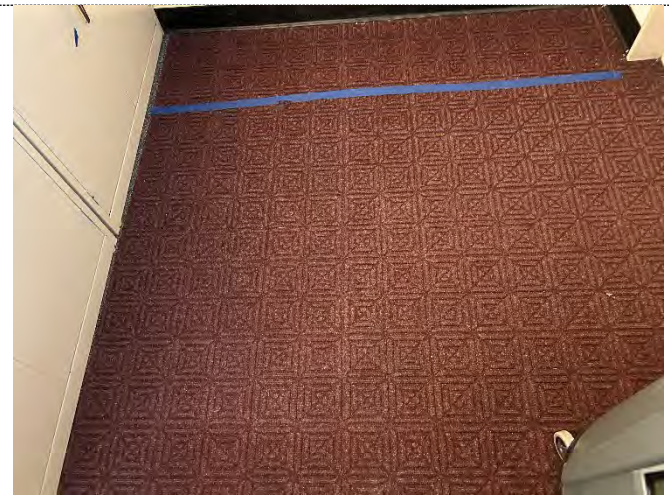


ACT & Glue – Textured Pinhole

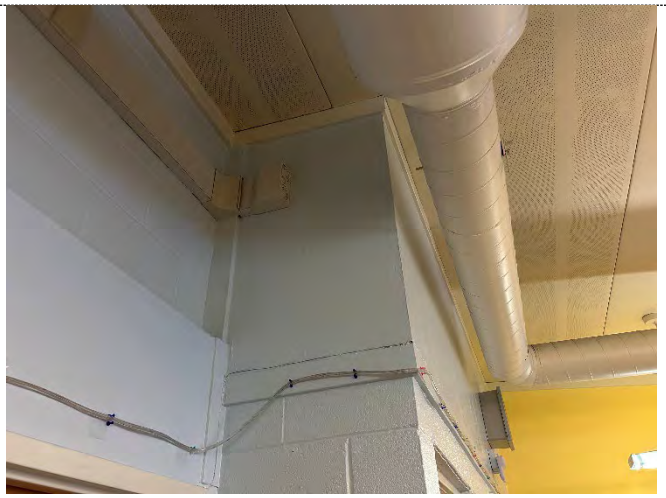


FCP – 2’ x 4’ Textured Pinhole

	
Duct Mastic	**Cementitious Panels**
	
Foam Insulation & Glue	Linoleum & Glue – Blue Wave
	
Drywall – Scatter Texture	Carpet & Mastic – Multicolored



Carpet & Mastic – Red Walk Off



Drywall – Knockdown Texture



Epoxy – Grey



Epoxy Coating – Grey Flecks
Grey Flecked Paint on Epoxy/Concrete Floor



VSF & Glue – Grey/Tan Specks



Bulletin Board Panels – Brown



FCP – 2’ x 4’ Pinhole Fissure



VFT & Mastic – 12” White/Light Blue



Vibration Dampener – Black



Fire Doors – 20 Minute Rating



Carpet & Mastic – Black/Tan Squares



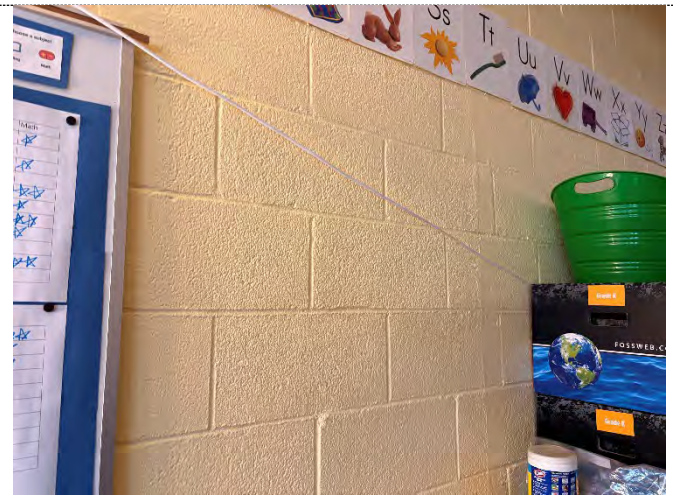
Tackboard – Tan



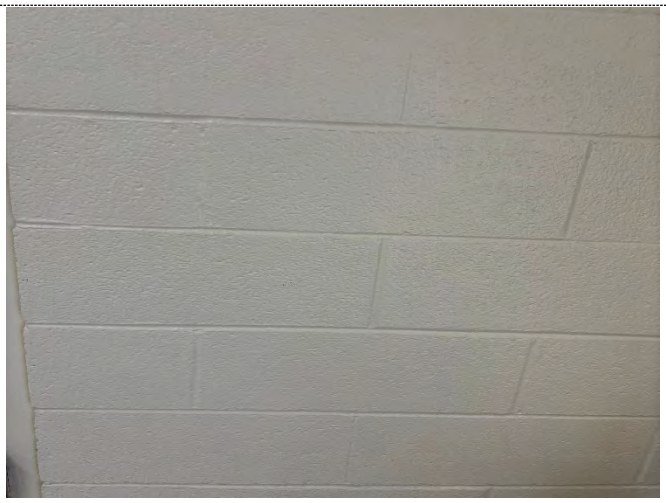
Dark Navy Paint on Metal Door Frame



Pastel Yellow Paint on Drywall Wall



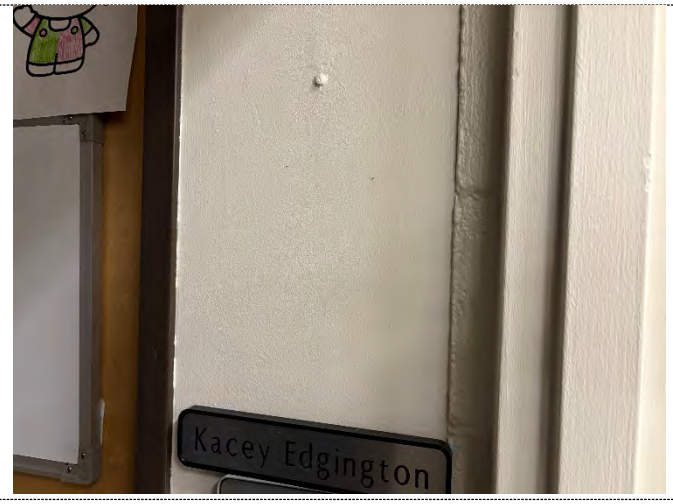
Pastel Yellow Paint on CMU Wall



White Paint on CMU Wall



White Paint on FCP Ceiling



White Paint on Drywall Wall



White Paint on Asphalt Basketball Court



Blue Paint on Metal Pole



Yellow Paint on Metal Pole



Golden Yellow Paint on Metal Railing



Orange Paint on Plastic Tunnel



Yellow Paint on Plastic Panel

Appendix F
Certifications of Personnel and Laboratories

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
DIVISION OF INDUSTRIAL RELATIONS
Occupational Safety and Health Administration
Asbestos Control Program

Certifies That Daniel Prado
Forensic Analytical Consulting Services
is Licensed As Asbestos Abatement Consultant

License No. IJPM-2057 Expiration Date 10/29/2026

Signature Of Licensee_____

Forensic Analytical Consulting Services, Inc.

This is to confirm that

Daniel Prado

Has attended the four-hour

AHERA Refresher Course for Asbestos Inspectors

And has completed the requisite training for asbestos accreditation under TSCA Title II

Course Date: 10-30-2025 to 10-30-2025

Certificate Number: PETBIR2025282

Valid Until: October 30, 2026

Cal/OSHA Approval Number: CA-025-06

FACS
Forensic Analytical Consulting Services

Fred J. Vinciguerra, Chief Executive Officer
Forensic Analytical Consulting Services, Inc.
21228 Cabot Blvd, Hayward, CA 94545
(800) 677-1483

United States Environmental Protection Agency

This is to certify that



Daniel J Prado

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226 as:

Risk Assessor

In the Jurisdiction of:

All EPA Administered Lead-based Paint Activities Program States, Tribes and Territories

This certification is valid from the date of issuance and expires May 01, 2029

LBP-R-I214705-3

Certification #

March 05, 2026

Issued On

Adrienne Priselac, Deputy Director

Land, Chemicals & Redevelopment Division

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
DIVISION OF INDUSTRIAL RELATIONS
Occupational Safety and Health Administration
Asbestos Control Program

Certifies That Ryan Hettich
Forensic Analytical Consulting Services
is Licensed As Asbestos Abatement Consultant

License No. IJPM-2342 Expiration Date 10/29/2026

Signature Of Licensee Ryan Hettich

Forensic Analytical Consulting Services, Inc.

This is to confirm that

Ryan Hettich

Has attended the four-hour

AHERA Refresher Course for Asbestos Inspectors

And has completed the requisite training for asbestos accreditation under TSCA Title II

Course Date: 10-30-2025 to 10-30-2025

Certificate Number: PETBIR2025280

Valid Until: October 30, 2026

Cal/OSHA Approval Number: CA-025-06

FACS
Forensic Analytical
Consulting Services

Fred J. Vinciguerra, Chief Executive Officer
Forensic Analytical Consulting Services, Inc.
21228 Cabot Blvd, Hayward, CA 94545
(800) 677-1483

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
DIVISION OF INDUSTRIAL RELATIONS
Occupational Safety and Health Administration
Asbestos Control Program

Certifies That Ty Bigham

Forensic Analytical Consulting Services,

is Licensed As An Asbestos Abatement Consultant

License No. IM-2483 Expiration Date 10/30/2026

Trainee

Signature Of Licensee _____

Forensic Analytical Consulting Services, Inc.

This is to confirm that

Ty Bigham

Has attended the four-hour

AHERA Refresher Course for Asbestos Inspectors

And has completed the requisite training for asbestos accreditation under TSCA Title II

Course Date: 10-30-2025 to 10-30-2025

Certificate Number: PETBIR2025275

Valid Until: October 30, 2026

Cal/OSHA Approval Number: CA-025-06

FACS
Forensic Analytical
Consulting Services

Fred J. Vinciguerra, Chief Executive Officer
Forensic Analytical Consulting Services, Inc.
21228 Cabot Blvd, Hayward, CA 94545
(800) 677-1483

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
DIVISION OF INDUSTRIAL RELATIONS
Occupational Safety and Health Administration
Asbestos Control Program

Certifies That Sydney Stedman

Forensic Analytical Consulting Services,

is Licensed As An Asbestos Abatement Consultant

License No. IM-2501 Expiration Date 10/03/2026

Trainee

Signature Of Licensee S. Stedman

Forensic Analytical Consulting Services, Inc.

This is to confirm that

Sydney Stedman

Has attended the twenty four hour

AHERA Initial Course for Asbestos Inspectors

And has completed the requisite training and passed the exam for asbestos accreditation under TSCA Title II

Course Date: 10/06/2025 - 10/08/2025

Certificate Number: PETBII2025021

Valid Until: October 8, 2026

Cal/OSHA Approval Number: CA-025-05

FACS
Forensic Analytical Consulting Services

Fred J. Vinciguerra, Chief Executive Officer
Forensic Analytical Consulting Services, Inc.
21228 Cabot Blvd, Hayward, CA 94545
(800) 677-1483

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 101150-0

Schneider Laboratories Global, Inc.

Richmond, VA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique on ISO/IEC 17025).

2025-04-01 through 2026-03-31

Effective Dates

For the National Voluntary Laboratory Accreditation Program

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

Schneider Laboratories Global

2512 West Cary Street, Richmond, VA 23220-5117

Laboratory ID: LAP-100527

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs, LLC (AIHA LAP) accreditation to the ISO/IEC 17025:2017 international standard, General Requirements for the Competence of Testing and Calibration Laboratories in the following:

LABORATORY ACCREDITATION PROGRAMS

☑	**INDUSTRIAL HYGIENE**	Accreditation Expires: September 01, 2027
☑	**ENVIRONMENTAL LEAD**	Accreditation Expires: September 01, 2027
☑	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: September 01, 2027
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:
☐	**BE FIELD/MOBILE**	Accreditation Expires:

Specific Field(s) of Testing/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2017 and AIHA LAP requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA LAP website (www.aihaaccreditedlabs.org) for the most current Scope.

Cheryl O. Morton

Cheryl Morton
Accreditation Director, AIHA Laboratory Accreditation Programs, LLC

Revision21: 10/24/2023

Date Issued: 09/01/2025

Right People

Right Perspective

Right Now

www.facs.com

FACS
Forensic Analytical Consulting Services

Hazardous Materials Specifications

Libby Booth Elementary School Modernization Project
1450 Stewart Street
Reno, NV 89502

Prepared for:

Washoe County School District Capital Projects

Created By:

Daniel Prado, FACS
IJPM-2057, US EPA LBP-R-I214705-3

Reviewed By:

Chris Chipponeri, FACS
IJPM-1410, US EP LBP-R-128230-3

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Site Address

Libby Booth Elementary School
1450 Stewart Street
Reno, NV 89502

Background

Washoe County School District (WCSD) will be performing an upcoming modernization project at their existing Libby Booth Elementary School site. This project will include various upgrades in classrooms in Buildings B and throughout Building D at the campus. The work onsite will involve the handling of lead-based components and lead-containing paints/coatings.

This set of specifications is to account for known and potential work to take place during all phases of the project.

Scope of Work

This project partly consists of the renovation and retrofit of multiple classroom and restroom spaces in Building B along with various upgrades, including a single-point entry and flooring upgrades throughout Building D which will impact lead-based components and lead-containing paints and coatings.

Construction of a new building on the southwest portion of the campus will also occur as part of this project.

This narrative is not a definitive scope of all work to be completed, including hazardous materials work, and is primarily intended to provide a general overview of the project. Project drawings and other construction documents developed shall be consulted to determine exact scope of work.

Forensic Analytical Consulting Services, Inc. (FACS) conducted a project-specific survey in the spring of 2026 to identify the hazardous materials within the planned project areas. This survey also incorporated previous sampling results from the Washoe County School District's (WCSD) Environmental Safety and Assessments (ES&A) Department.

Asbestos-Containing Materials

All materials in the project's planned scope of work were found to **not contain** asbestos.

Asbestos-containing materials are in various spaces adjacent to the project area. The WCSD Material Disturbance Permit (MDP) and FACS' hazardous materials survey report should be consulted if the project scope expands outside of the planned locations to determine asbestos content of the materials to be disturbed. As asbestos-containing materials are not anticipated to be impacted, requirements for the handling of asbestos-containing materials have not been included in these specifications. In the event that asbestos-containing materials will be disturbed, WCSD will retain FACS to provide an asbestos work plan for Contractor to comply with during abatement activities.

Lead-Based/Containing Paints & Coatings

All paints and coatings within the project area of this phase were found to be lead-containing except for the following:

- Blue Paint on Metal Poles
- Brown Paint on Metal Beams
- Golden Yellow Paint on Metal Railing
- Grey-Blue Paint on Metal Column
- Orange Paint on Plastic Tunnel
- Tan Paint on Metal Column
- White Paint on Acoustic Wall
- White Paint on Asphalt Basketball Court
- White Paint on Drywall Wall
- White Paint on FCP Ceiling
- Yellow Paint on Metal Pole
- Yellow Paint on Plastic Panel

The following components were found to be **lead-based**:

- White Porcelain Toilets

Any work disturbing lead components, paints, or coatings must be performed using lead-safe work practices by personnel with OSHA Action Level training.

Project Requirements

These specifications identify only a general narrative for the scope of work for this project. The contractor is responsible for reviewing project drawings and construction plans, along with completion of own measurements, inspection of site conditions, and any other items required to submit their bids and complete the project.

Within these specifications are means and methods for the removal of materials that will be followed on the project for all known work to be completed and additional work that may potentially be required. As not all potential circumstances or conditions can be anticipated, minimal field adjustment of the means and methods listed within this document may be required.

The general contractor and any sub-contractors working onsite will need to consult the WCSD ES&A Department's Material Disturbance Permit (MDP) to verify asbestos and lead content of materials prior to impacting any materials. In addition, FACS has provided a site survey report for the areas inspected as reference, but this document does not take precedence over MDP or project drawings and other construction directives.

Testing of materials not previously sampled or testing to verify asbestos and lead content of materials will only be performed by WCSD ES&A Staff or District's independent third-party consultant. Testing by another third-party consultant will not be accepted as proof of the asbestos-content of building materials or lead-content of paints or coatings.

The lead paint inspection conducted by FACS identified lead-based components within the project area. However, the EPA's Renovation, Repair and Painting (RRP) rule does not apply since the lead-based ceramic body/glaze is neither a surface coating nor a painted surface as defined by 40 CFR Part 745.

The contractor must meet requirements set forth in these specifications, and applicable Federal, State, and local requirements, namely the OSHA Lead in Construction Standard, when handling paints or coatings that do contain lead.

As noted above, many of the paints and coatings in the project areas contain lead. Thus, the contractor shall be cognizant that not all work disturbing lead may be reflected in the drawings. For example, work involving the removal of baseboard materials from painted surfaces or removal of equipment from painted surfaces may require lead work activities to be performed but may not be explicitly listed on project drawings as lead work activity.

Many of the materials that may be disturbed as part of the project contain silica. The contractor is responsible for complying with the requirements of 29 CFR 1926.1153 – OSHA's Crystalline Silica Standard for Construction. Proof of compliance with the Standard shall be provided by contractors at the District or independent third-party request.

Contractor shall be approved by the WCSD ES&A Department to perform asbestos and lead activities within the District. **Firms which have not previously performed activities impacting asbestos or lead for the District will need to submit for approval all necessary documentation outlined in the WCSD ES&A Technical Specifications for the project at least fifteen (15) business days prior to work commencing.** The approval of firms includes contractors that will be performing work impacting lead-containing paints, even if that firm is not primarily a lead remediation contractor.

All worker asbestos and lead training certifications shall be submitted for approval to the WCSD ES&A Department at least fifteen (15) working days prior to project commencement at minimum. Online training of employees is not sufficient to meet the requirements of District policy and all training must be provided in-person with each individual receiving a training certificate from the training provider.

Contractor is responsible for reviewing WCSD ES&A worker roster for the company to ensure that all workers to be used on the project have been approved prior to arrival onsite. Workers not identified on the approved WCSD ES&A worker list for the contractor will not be allowed to perform any activities onsite, even if documentation is provided onsite at time of the project commencement or work. This applies to any personnel impacting lead-containing surfaces, even if not primarily a lead remediation contractor.

The contractor performing work on this project will be responsible for following all plan requirements to complete the project. Neither WCSD personnel, nor any independent consultant providing project oversight, will be responsible for identifying materials or components as part of this contract. The contractor's onsite supervisor(s) shall have a copy of these Specifications on site at all times and shall be familiar with the project requirements prior to arrival on site for the project. Failure to follow requirements of these Specifications, or lack of knowledge of requirements to be followed during the project are grounds for replacement of contractor's onsite supervisor.

No work impacting hazardous materials shall be performed when staff and students are present within buildings or in adjacent exterior areas of the site.

Only the hazardous materials contractor will be allowed to occupy the designated work area once lead activities are scheduled to start. This applies to all WCSD non-ES&A staff/personnel, general contractor, and other sub-contractors. The designated work area shall only be occupied by the hazardous materials contractor, WCSD ES&A staff, and District's independent third-party abatement consultant.

Work that is deemed "penetration and attachment" by the District's ES&A Department or District's onsite third-party hazardous materials consultant shall be performed in accordance with the District's policy for this type of work. These specifications may have applicable requirements that may be included for overall project compliance, but do not identify all work practices or engineering controls that would need to be met for compliance with the District's penetration and attachment policy.

Water, HVAC, and Electricity

Water and electricity are available onsite currently; however, long hoses and cords may be necessary. Contractor shall provide a GFCI at the primary plug-in of all electrical trains used for electrical equipment. Hose washers shall be provided at all connections to prevent leakage of water and potential damage to District facilities. Contractor is responsible for any damage caused by their usage to any District water or electrical systems.

Contractor shall coordinate with the WCSD Project Manager for the shut-down of all HVAC systems within the project area prior to commencing setup for lead removal activities. Contractor is responsible for the lock-out / tag-out of all electrical circuits and HVAC systems that may be impacted by the project. Contractor shall follow requirements of WCSD for the lock-out / tag-out of equipment.

Lighting

If exterior work will take place in the evenings or in non-lit areas, the Contractor shall provide temporary lighting as required for workers to clearly see materials to be abated, traverse through the work area, and move waste to the waste receptacle. Sufficient lighting shall be provided to allow visual inspection to be performed at the conclusion of each work shift by the District's independent third-party consultant; additional lighting may be necessary for a final clearance visual inspection.

Lighting used shall meet requirements for safety as set forth by OSHA requirements. All lighting shall have a sturdy base and guards to protect bulbs from breakage in the event they are dropped or knocked over.

Pre-Cleaning

No pre-cleaning of asbestos or lead contamination at project areas is required to complete this project; however, small amounts of garbage and build-up of dust may be required to be cleaned to allow sufficient adherence of containment barriers.

Notifications

No notification is required for the removal or disturbance of lead-containing components, but the contractor performing lead work shall provide notice of work to the WCSD ES&A Department and District's independent third-party consultant at least 48 hours prior to commencing activities, including setup of containment.

Equipment

Contractor is responsible for providing all necessary equipment in sufficient quantities to complete the work in the schedule provided for the project. All equipment must arrive onsite clean and in proper functioning order. Any equipment that arrives onsite dirty or not in proper functioning order shall be removed from the project site for cleaning and/or repairs.

The requirement for clean equipment in proper working order extends to any rental equipment used on the project. If rental equipment is used, contractor shall provide notification in writing to the rental agency that equipment will be used within a lead regulated work area. Proof of this notification being filed shall be provided to District's independent third-party consultant upon request.

Operators of lifts or other similar powered equipment must be trained in the use of equipment to meet manufacturer and OSHA requirements. Proof of training shall be provided if requested to WCSD and District's third-party consultant.

Training

Workers performing tasks impacting lead paints or coatings, regardless of level of lead present, must have OSHA Lead Action Level training. This requirement extends to any contractor and their personnel performing penetration and attachment activities.

As noted previously, all workers certifications must be approved by the WCSD ES&A prior to arrival onsite to start work. Certifications shall clearly identify the name/level of the training and provide the complete name of the worker. Failure to meet these requirements may cause a delay in approval or a complete rejection of certifications until corrections can be made and new copies obtained by the contractor.

Copies of the worker certs will also be requested to be provided to the District's onsite third-party consultant as well. Web-based or virtual training is prohibited by District policy.

As this project may take place over multiple phases, contractors are responsible for continuing to ensure worker roster is up to date with staff certifications. Certifications cannot be approved onsite by the District's independent third-party consultant.

Personal Protection Equipment

All personnel entering a regulated area, regardless of level of work to be performed, shall wear disposable coveralls, tight-fitting half-face, negative-pressure air purifying respirators fitted with HEPA (P-100) filters, hard hats and safety glasses at minimum. Street clothes may be worn beneath disposable coveralls for any exterior lead activities, but street clothes will be HEPA-vacuumed clean if coveralls are torn or ripped. Requirements of PPE extend to any contractors disturbing hazardous materials, even if they are not primarily a remediation contractor.

All employees shall have a valid medical clearance and fit test for the respirators to be worn. Copies of the medical clearance and fit test must be provided to the District's onsite independent third-party consultant. The contractor may opt to include additional PPE items based on their own job hazard assessment for the project, but they may not reduce level/type of PPE below what is required in this Specification.

Personal Air Monitoring

The contractor is responsible for the collection of personal air samples on 50% of workers entering a regulated work area during lead disturbance activities. If an odd number of workers are entering the regulated work area, the contractor shall round up for the number of workers to be monitored (i.e., five workers entering a work area

would require collection of three samples). These samples shall be collected in accordance with OSHA sampling protocols and analyzed by a laboratory with the proper accreditation and approval from the WCSD ES&A Department.

The contractor shall have their laboratory submit or fax, within **48 hours** of the date the sample was collected, the final laboratory result documents (including legible chain-of-custody) for air monitoring to the WCSD ES&A Department. No handwritten results reports will be allowed. The laboratory reports will reference the air monitoring cassette's factory assigned number and the personal air monitoring results must be properly applied to an 8-hour time weighted average. Failure to submit results within the required 72-hour period (48-hour turnaround with 24-hour grace period) may result in the District temporarily stopping the applicable remediation project until results are received. Continued failure may also result in the termination of the contract.

The District's independent third-party consultant reserves the right to halt work or increase respiratory protection in the event that personal air sample results are not received in the manner as specified above, or if area air sampling shows current respiratory protection does not sufficiently protect employees.

Security and Safety

The Contractor is responsible for security of all equipment and safety of all employees. Contractor shall provide any storage containers or security needed for tools and equipment if they are to be left onsite. Contractor shall coordinate with the WCSD Project Manager for placement of any storage container brought onsite.

Contractor is responsible for security of the building at locations that have components removed before replacement (for example, after removal of wall-mounted louvers, doors, windows, etc.) or components removed to create openings for the exhaust of negative air machines. In addition, contractor is responsible for enclosing any decontamination chambers sited at exterior areas of a structure in plywood. Security measurements must meet the approval of general contractor and WCSD.

Contractor is responsible for all worker safety and following all applicable regulations, namely Nevada and Federal OSHA. Contractor or their designated supervised shall hold a safety meeting on the first day of the project that addresses all safety hazards workers may encounter.

Safety meetings shall be held at least weekly thereafter, or in the event that job hazards change or an accident occurs. The safety meeting topics shall be documented and all attendees sign the document for recordkeeping. A copy of the safety meeting shall be provided to the District's independent third-party consultant.

Work Hours and Dates

A specific schedule of calendar dates for the project will be provided in other contract documents. However, it is anticipated that workdays and hours will be Monday through Friday, 07:00 am to 03:30 pm. Work hours will be 03:30 pm to 11:00 pm when school is in session.

WCSD holidays are excluded dates of work and no work shall be scheduled for these dates. As noted above, a detailed schedule of project events, including shift hours, shall be provided for approval by WCSD.

The contractor may request alternate days or hours in writing to the WCSD Project Manager for approval, but it does not guarantee acceptance. The request must be filed at least 48 hours prior to the first alternate shift commencing.

Occupancy

As noted previously, the immediate project area will be limited to the hazardous materials contractors, WCSD ES&A staff, and District's independent third-party consultant once remediation activities are ready to commence. Once the area has been cleared, other parties may occupy.

Emergency services may also occupy areas in the event of an emergency during the project.

Challenge Testing

All HEPA-filtered equipment to be used on this project shall be challenge tested (DOP or equivalent) at the project site prior to use. If the remediation on this project extends over multiple mobilizations, the HEPA-filtered equipment shall be tested prior to use for each mobilization.

Copies of the challenge testing results shall be provided to the WCSD ES&A and/or District's independent third-party consultant.

No HEPA-filtered equipment will be allowed to remain onsite after a contractor demobilizes from the site or stored onsite when the contractor cannot guarantee security of the equipment.

Air Pressure Differential Requirements

All interior containment areas where more than six (6) square feet of lead-containing painted or coated materials are to be removed shall be placed under negative air pressure. An air pressure differential of -0.050" WC must be established and maintained through all remediation activities until clearance sample results are received. The air pressure differential shall be displayed and recorded by a properly functioning manometer at each negative pressure enclosure location. Failure to have a properly recording manometer will require the Contractor-Supervisor to record the air pressure differential by hand at 10-minute intervals, including recording of any pressure differential loss and re-establishment of sufficient air pressure differential. The manometer display shall have the correct date and time for the data being recorded and this requirement extends to any handwritten data. Copies of the air pressure differential readings shall be provided to the ES&A Department and District's independent third-party consultant.

Interior Lead-Based or Lead-Containing Painted Component Removal

The following requirements are intended to cover all work at the interior of the building where lead-based components or lead-containing paints/coatings are to be impacted by renovation activities.

All interior containment areas where more than 6 square feet of lead-containing painted or coated materials are to be removed/disturbed shall be placed under negative air pressure. The requirements will still apply to areas where less than 6 square feet of lead-containing painted or coated materials are to be removed/disturbed except for the negative pressure requirements. This work will occur in a regulated area or mini containment as directed by the District's third-party consultant based on the potential amount of debris generated by the removal process.

All poly used on this project shall be 6-mil in thickness and fire-retardant, unless exempted below.

1. Critical barriers shall be erected at all openings within the work area and shall be sealed with two layers of 6-mil poly. Examples of openings include, but are not limited to, doors, HVAC registers, windows, etc.
2. Two layers of 6-mil poly shall be placed over the floor surface of the work area, extending out at least 10 feet in each direction. This poly sheeting may be extended if materials being disturbed cannot be contained to the poly drop sheets. Poly may also be reduced if vertical containment is used to isolate work.
3. Fixed objects that cannot be re-located shall be covered with one layer of 6-mil poly and fully-sealed.
4. One layer of poly shall cover wall surfaces within areas that ceiling finishes are being removed and wall surfaces shall remain in place, in addition to the required floor poly.
5. Contractor shall install a 4-mil poly ceiling as needed to establish and maintain sufficient air pressure differential within the negative pressure enclosures.
6. All seams in poly shall be overlapped at least four inches (4") to prevent debris or dust from falling behind poly barriers.
7. A wash station shall be sited at all lead regulated areas to allow workers to decontaminate tools, waste bags, and themselves as they exit the regulated area. This area shall consist of poly drop sheet with wash station consisting of wet-wipes, towels, and soap. A waste bag for the disposal of applicable PPE and decontamination waste shall be in the area as well.
8. A three-stage decontamination chamber system shall be attached to the negative pressure enclosure. The requirements for this system are detailed below.
9. Sufficient negative air machines shall be installed within the containment area to generate the required air pressure differential of -0.05" WC or greater.
10. All negative air machines shall be exhausted to the exterior of the building. This may require the contractor to secure doorways, windows or other openings with plywood and tamper-proof bolts for negative air machine exhaust.
11. An airless sprayer with amended water and HEPA-vacuum shall be within the containment area prior to approval of work commencing.
12. All poly barriers that may allow access into a regulated area shall have signs installed at clearly visible locations to prevent tampering or breaching of containment areas. These barriers may be at doorways, free-standing poly walls, or similar locations.
13. Viewports shall be installed in poly walls to allow unobstructed view of the work area by inspectors. Location of viewports may be installed in areas at the direction of ES&A or District-hired independent third-party consultant.
14. Posting of signs and barrier tape may require the contractor to supply pylons or similar to mount barrier tape around the regulated area.
15. Signs shall meet requirements set forth in 1926.62(m) for a lead regulated area. Signs shall be posted once the containment area has been approved, but before any remediation begins.
16. Any use of a mechanical tool to cut through paints or coatings must have a shroud that is attached to a HEPA-vacuum providing sufficient local exhaust. Insufficient capture of painted debris by the shroud system will stop work until the issue can be resolved to the satisfaction of the ES&A Department or District's independent third-party consultant.
17. Contractor shall ensure that any remaining paints or coatings at the edge of removal area or components that are to remain, are tight to the substrate. Contractor is responsible for stabilizing any loose paints caused by their work or required as part of the work.
18. Material waste shall be bagged as it is generated to prevent a build-up within the work area. No un-bagged waste may remain within a work area at the conclusion of a work shift, including lunch breaks.
19. Once all lead work is completed, all work surfaces shall be wet-wiped and HEPA-vacuumed clean of all dust and debris.

20. All waste shall be double-bagged and labeled as necessary for disposal prior to removal from the work area. At least one of the waste bags shall be sealed in a "gooseneck" fashion to create a leak-tight container.
21. All waste, non-essential supplies, and equipment shall be removed from the containment area prior to a final visual inspection. To pass a final visual inspection, all removal shall be completed as indicated by project plans or direction from general contractor, paints remaining in work area shall be tight to the substrate, and the work area must be clean of all dust and debris.

Regulated Area Signage

Lead Hazard signs shall be posted at all entrances to a containment or regulated area as appropriate for work being performed. Signage will be posted after a pre-start visual is passed and work may begin in the containment, but no work shall start until all signs are posted.

Signage shall meet the revised requirements for lead set forth in 29 CFR 1926.62(m).

Decontamination Requirements

No consumption of food or fluids shall take place in the decontamination or load-out systems. Workers that wish to consume food or fluid shall fully exit the containment and decontamination system, including the doffing of all contaminated PPE.

Workers that fail to meet this requirement and remove PPE within a regulated area will be immediately removed from the project.

A three-stage decontamination chamber for worker ingress/egress shall be attached to all negative pressure enclosures. One system shall be required for every 10 workers that may be working within a containment area (i.e, 10 workers = 1 system, 11 workers = 2 systems). This chamber system shall consist of a dirty chamber, a shower, and a clean chamber. The decon chambers shall be constructed of 6-mil poly and each chamber shall be at least 3'L x 3'W x 7'H. A curb of at least 4" shall exist between each chamber to prevent the movement of debris or material from chamber to chamber. Each chamber shall be separated with a Z-flap that will seal closed in the event of a power outage.

The water in the shower shall be supplied by a properly functioning shower head. Both hot and cold water must be available and water temperature shall be controllable by workers using the shower. A splash pan may be required if workers cannot keep water contained into the shower system. The shower system shall have a filtration system that filters water down to 5 microns prior to discharge into a storm drain system. Soap, shampoo, towels and a waste bag for disposal of contaminated disposable PPE is required to be in the decontamination chamber system.

The floor of the dirty chamber shall have two layers of 6-mil poly. The top layer of the poly shall be replaced daily or more often if needed to maintain an acceptably clean decontamination system at the third-party consultant's discretion. Failure to keep any chamber of decon system in acceptable condition will be grounds for a work stoppage until cleaning has occurred and procedures have been corrected.

The contractor may opt to construct waste load-out chambers at containment areas. These chambers can be larger than worker decontamination systems, but the required air pressure differential must be maintained at all times and system shall be of reasonable size for the contractor to manage. Load-out chambers must be

constructed of 6-mil poly and framing shall be sufficient to provide a sturdy construction. There must be self-sealing flaps between chambers of the load-out chamber. Load-out chambers can be reduced to no less than two chambers and only upon approval by the District's third-party representative. Asbestos and/or lead signage shall be posted as appropriate at the load-out chamber and required PPE shall be worn in the load-out chambers as needed to comply with posted signage.

At no time will any ride-on equipment be used to access the load-out chambers to move waste. At no time will flaps of the waste load-out chambers or the worker decontamination system be pinned back to create a "tunnel" that does not provide an airlock between air chambers. At no time will a waste bin be directly attached to a containment or load-out chamber. At no time will waste be loaded into the load-out or decontamination system which prevent egress/ingress in the event of an emergency.

Failure by the contractor's onsite supervisor to monitor work crew and prevent this from occurring is grounds for dismissal of the supervisor and potentially crew members that fail to correct actions.

Disposal Requirements

Lead

Contractor is responsible for the waste characterization profiling of all lead waste to be disposed of. Copies of the laboratory results, including chain-of-custody, must be provided to WCSD ES&A or independent third-party consultant prior to disposal.

Lead-containing materials may be recycled, but a letter signed by the recycling facility acknowledging the lead-content of materials must be provided by the contractor prior to removal of such materials from the site.

The contractor will need to provide a fully enclosed, lockable waste bin for all waste created on this project. Waste bin will need to be labeled with lead signage once the waste is loaded into the bin. Waste bins shall be lined with one layer of 6-mil poly prior to waste being loaded.

General Waste Bin Requirements

Waste bins will need to arrive onsite clean of debris or any other waste and in proper functioning order. Waste bins may be rejected by WCSD ES&A staff or District's independent third-party consultant if these conditions are not met, with no extra charge to the District. Plywood or similar material shall be placed below the casters or feet of the bin to prevent damage to site grounds. The contractor will be responsible for any damage to the site grounds by waste bin delivery, storage, or haul-off.

In the event that work will be conducted during the school year, any waste bins onsite shall be isolated from students using temporary construction fencing. In addition, waste bin collection and delivery shall only be conducted when students are not present on campus.

Lead Wipe Sampling Criteria

The District will hire the independent third-party consultant to perform lead wipe sampling prior to commencement of work. The consultant will collect wipe samples from floor and/or adjacent horizontal surfaces within the work areas to verify lead dust levels prior to work commencing. If cleaning of a surface to remove a detected lead hazard is required, the contractor shall be notified, and the hazardous materials contractor will be required to pre-clean to remove the hazard.

At the conclusion of lead disturbances, a post wipe sample will be collected from the interior work area, following removal of the containment poly. If post project wipe samples indicate that an EPA lead hazard exists, or if samples indicate a higher level of lead on surfaces than pre-project wipe samples showed, then recleaning of the work area will be necessary. Recleaning process will be required to be repeated until wipe samples indicate lead levels are below both current EPA hazard levels and below pre-wipe sample levels.

Clearance

Once an area passes visual clearance for the materials removed, wipe sampling will be performed by the District's independent third-party consultant. Following are the requirements that must be met for clearance to be met and allow containment removal so that non-remediation personnel may re-occupy the space:

Lead

As noted previously, pre-job and post-job lead wipe samples will be collected in spaces to verify the contractor has not created a lead hazard by removal of their containment area and to verify that the spaces can be re-occupied by non-lead trained personnel. Lead wipes will be collected at **all** locations where lead-containing paint is disturbed in a manner that exceeds the WCSD ES&A Attachments and Penetrations procedures.

In the event that a lead hazard has been created by a contractor, such as improper disturbance of painted surfaces outside of a contained area, the District's ES&A staff or independent third-party consultant will collect clearance dust wipes in the affected area. If a lead hazard has been created, the contractor performing the improper disturbance will be responsible for all cleaning costs required for the lead remediation contractor to abate the hazard and for collection of clearance dust wipe or soil samples to document that the lead hazard has been remediated.

The contractor is responsible for all costs of labor and laboratory analysis for the collection of clearance air or wipe samples past the initial sample set collected within a containment area. This includes collection of samples due to failure to meet clearance requirements on the initial set of samples, contractor setting up more containment areas that reasonably expected, and contractor improper disturbance to surfaces after samples are collected but before analysis is completed.

Created by: Daniel Prado, FACS, IJPM-2057, US EPA LBP-R-I214705-3
Reviewed by: Chris Chipponeri, FACS, IJPM-1410, US EP LBP-R-128230-3
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ASBESTOS ABATEMENT TECHNICAL SPECIFICATIONS – EFFECTIVE 1/25/23

PART 1 – GENERAL REQUIREMENTS

1.1 LOCATION

This asbestos abatement is to take place at: Libby Booth ES, Remodel 2026, Issued 9/9/26

1.2 DESCRIPTION

The work shall include the furnishing of all labor, tools, and equipment, material, transportation, ALL waste disposal fees and services to include waste characterization sampling costs and the performance of all operations required to properly provide the work. The Contractor will be supervised by District AHERA certified personnel or District Hired Asbestos Consultants and the abatement work will be coordinated through the Regulated Systems and Assessment department. The work shall also include obtaining required permits and notifying regulating agencies as required by all applicable state, local and federal laws and regulations for the work to be performed. Notification fees and disposal manifest fees are to be paid by the Contractor. Contractors are reminded that non-friable asbestos projects may not require regulatory notification, but non-friable materials that have been made friable in the opinion of the regulatory agency require notification. Mastics removed with buffers require notification. It is the responsibility of the Contractor to determine if regulatory notification is required and any monetary citations that result from failure to notify or improperly done notifications will be fully the responsibility of the Contractor. Should the District be named in addition to the contractor, due to a Contractors failure or improper notification, the contractor shall be required to reimburse legal fees to defend the District, as well as the cost of any monetary citation that results. The work shall also include the cleanup and removal from the site of all debris resulting from the operations performed. Waste disposal of all materials removed from the site shall be performed in a manner consistent with these specifications and all applicable regulations and the Contractor is required to complete properly and pay for all waste characterization sampling costs. The Contractor shall be responsible for submitting the application for the waste disposal permit and the contractor will be responsible for the picking up and the payment of the fee for the permit. The Contractor will submit the waste application to the District prior to submittal to the Health Department for signature. It shall also be the Contractors responsibility to take all necessary safety precautions and to furnish security barricades, and/or any safety measures as may be required to properly separate the abatement areas from the public. All taxes/fees associated with the disposal of asbestos containing wastes, regulated or not, shall be the responsibility of the abatement contractor.

As the District may decide to pay a third party consultant to supervise projects, the District would have to pay the consultant additional money or pay overtime to district employees for weekend and overtime work. The work schedule of this project will be set by the Construction Department Project Manager. If the contractor must work additional time or hours not identified in the initial schedule, due to the contactors inability to man the job with enough workers, the District may require the contractor to reimburse the district for additional costs for consultants incurred by the District. **The Contractor will be required to staff this project with enough personnel to ensure completion within the required timeline.** The Contractor shall provide at all times sufficient and competent labor to carry on the work

properly and insure completion of each part in accordance with schedule and within the time agreed to. An employee of the Contractor or subcontractor, who is deemed incompetent, disorderly, or otherwise objectionable by the Owner, shall be removed promptly by the Contractor, and not re-employed on the work. Any employee of the Contractor that is observed that is not utilizing his personal protective equipment will be immediately removed from a project and not allowed on any other District projects. Should any disagreements result regarding the identification of the employee or his/her proper use of personal protective equipment, the determination of the District Regulated Systems Supervisor or District hired Consultant will be considered final and conclusive. The Contractors Asbestos Abatement Supervisors who allow employees to not utilize their personal protective equipment will be immediately removed from a project and not allowed on any other District projects. Contractors will be required to replace removed employees/Supervisors and no additional time will be allowed to complete the project.

When possible without the disturbance of asbestos-containing materials, it shall be the responsibility of the **OWNER** to remove and replace all loose and attached furniture, cabinets, bookcases, etc. before the project commences. The removal of these items, where removal impacts asbestos-containing materials, and re-hanging of doors that have to be removed because they impede removal will be the responsibility of the contractor.

The **OWNER** will be responsible for air sampling for the purpose of project clearance. The Contractor shall not include the cost associated with clearance sampling in his bid. The Contractor shall be responsible for all personal and area air monitoring required by regulation, the technical specifications or required by the Contractor's asbestos liability insurance carrier.

The **OWNER** shall be responsible for the cost associated with the initial air sample clearance requirements. If the initial sample analysis results do not pass for clearance, the Contractor will be responsible for the cost of all additional air sample analysis until clearance is achieved.
In the case that a project requires the isolation of toilet facilities it shall be the responsibility of the Contractor to provide alternative facilities as needed, if no alternative facilities are available on-site. If the Contractor utilizes District toilet facilities, the Contractor will be required to maintain the cleanliness of the designated District toilet facilities.

The contractor will be required to assign enough personnel and equipment to complete all projects scheduled for completion during each site's normal work hours. Costs to provide access to facilities after normal work hours, due to a Contractors inability to meet the schedule during normal hours will be passed on to the Contractor and deducted from a project's final payment.

There may be supplemental asbestos abatement specifications created by an outside asbestos consultant and provided to the Contractor to provide additional information. The Contractor must refer to all specifications provided in the bid package, and comply with all specification requirements. If there are any conflicts regarding asbestos abatement specification requirements, Contractors are required to comply with the most stringent requirement. Conflicts/disagreements regarding specification requirements will be settled based upon direction from the WCSD ES&A Department AHERA Project Designer certified staff.

1.3 EQUIPMENT

If requested the Contractor shall provide proof acceptable to the District that Contractors has disposal is enough equipment to support this project. Delays of up to 48 hours are to be anticipated for TEM Laboratory analysis result turnaround and abatement project schedule will reflect this delay. Additional equipment needs may result and the Contractor will be required to have enough equipment to proceed with work as schedule in spite of delays in awaiting final clearance sampling.

1.4 ASBESTOS LIABILITY INSURANCE REQUIREMENTS

The Contractor will be required to written proof by way of an insurance certificate of a minimum of Five Million Dollar ($5,000,000.) Occurrence Based Asbestos Environmental Risk Liability Insurance from a domestic Insurance company that has an A, A+ or A++ rating in Best's Insurance Guide, OAE. The Asbestos Abatement Contractor shall name the WCSD additionally insured on a primary and non-contributory basis for the contract term as well as any asbestos consultants the District may hire for job design and/or supervision and shall provide an insurance certificate specifically naming them as additionally insured, primary and stating that the policy cannot be cancelled in less than 30 days for any reason including non-payment.

1.5 LOCK OUT/TAG OUT PROGRAM

The Contractor will be required to comply with the Districts Lock Out/Tag out procedures. Requirements are available to contacting the WCSD safety officer.

1.6 WORK HOURS

The work schedule of this project will be set by the Construction Department Project Manager. Contractor must determine the work hours by reviewing the other contract documents and specifications or address these issues with the Project Manager so all Contractors are clear of the required abatement schedule prior to bidding on this project. These asbestos abatement specifications are not meant to set work hours or schedules rather the procedures to be used to abate asbestos containing materials within the district. The WCSD, ES&A department will be the entity ensuring the abatement specification are being properly being addressed by Contractors but the day to day scheduling and project specifics, not related to abatement procedures, will be administered by the Construction Department of WCSD.

SECTION 02110

ASBESTOS ABATEMENT: GENERAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. These specifications cover the removal of specific types of asbestos containing material for the Washoe County School District. Refer to the project drawing for exact abatement information and locations. The work may include the abatement of asbestos containing material (ACM) on floors. New flooring materials will be installed over abatement areas so mastic removal techniques employed by the abatement contractor are to be done so that installed flooring products are able to be warranted by the flooring manufactures. If the abatement contractor is being hired by a flooring contractor the abatement contractor must consult the flooring installer and ensure their employed removal techniques do not void any warranties for new installed products. It is quite possible that chemical mastic removers may not be able to be utilized to achieve this requirement. No power tools may be used to remove asbestos containing materials unless approved by the District and the applicable regulatory authority. All carpeting in the areas shall be removed and disposed of as ACM, as directed by the District. Work will require use of a negative air pressure system and depending upon personal air sampling may require Type "C" supplied air respirators. Transmission Electron Microscopy (TEM) or Phase Contrast Microscopy (PCM) will be used by the District to establish final airborne asbestos levels prior to acceptance of the work by the District; final levels of airborne asbestos fibers at the completion of the work shall be in accordance with AHERA Regulations (40 CFR Part 763).

B. Polished Concrete and Concrete Grinding: The district may be grinding and or polishing concrete in scheduled areas after a flooring asbestos abatement project has been completed. In cases that polished concrete will be a part of the scope, **or concrete grinding will be required after abatement**, Contractors will **not** be allowed to utilize solvent mastic removers or any other method that liquefies the matrix of the mastic which could contribute to the mastic entering into cracks, and pores of the concrete. The exception to this would be the use of a fully HEPA vacuum shrouded techniques, such as water jet or hydro blasting. The intent of this requirement is that all mastic will be removed and no liquefied mastics will remain at the conclusion of work. If grinding of the concrete is required, it will happen after the final asbestos air clearance has passed and the asbestos abatement is complete. The poly containment that has been built, during the asbestos abatement phase, might be very helpful and cost effective if it were left in place for the concrete grinding contractor to use. So once the final clearance and abatement contractor has removed all signage, asbestos contaminated materials and the negative pressure machines, the grinding contractor may want to make arrangements with the abatement contractor to leave the poly containment up. All arrangements regarding the logistics of this agreement are up to the contractors' responsibility to determine. Contractors performing concrete grinding will be required to comply with District specifications regarding silica exposure during the grinding phase.

C. INTENT

1. These specifications are intended to describe all material, labor, and equipment necessary for asbestos material removal.

2. The listing or mention of any method of installation, erection, fabrication, or workmanship shall not operate to make the Contractor an agent, but shall be for the sole purpose of setting a standard of quality for the finished work; an alternate method may be approved in writing by the District if it results in quality equal to that intended by these documents, without increasing the District's liability. Unless an alternate method is approved, all work shall be in strict accordance with all methods of installation, erection, fabrication, and ownership listed or mentioned herein. In addition, while the methods are provided, the Contractor will be required to ensure any method utilized complied with all applicable regulations.

3. It is the responsibility of the Contractor to verify the square footage of asbestos containing material that needs to be removed on this project. The Contractor shall remove all asbestos-containing material from the areas as directed.

1.02 DESCRIPTION OF WORK

A. Furnish all labor, licenses, notifications, payment of notification and waste manifest fees, permits, materials, services, insurance, associated taxes, and equipment to complete and dispose of all asbestos containing materials and asbestos-contaminated material as directed by the District. Base cove materials inhibit the removal process and trap contaminated materials, therefore all removable base cove materials must be removed as a apart of the abatement process of flooring materials.

B. CORRELATION OF DRAWINGS AND SPECIFICATIONS

1. In general, the specifications will describe the "quality" of the work. The specifications are cooperative and supplementary; however, each item of work is not necessarily mentioned in the specifications. All work necessary to complete the projects so described is to be included in this Contract.

2. In case of disagreement within the specifications, the better quality of the work shall be estimated and the matter drawn to the District's attention for decision and/or adjustment. Any work done by the Contractor without consulting with the District, when the same requires a decision, shall be done at the Contractor's risk.

3. Omissions or Errors. If any omissions or errors in technical specifications are noted, or instructions at variance with the obvious intent of the document, it is the responsibility of the Contractor to call them to the District's attention before performing the work.

C. INTERPRETATION OF "OR EQUAL"

1. The use of trade names, with a notation such as "or equal" in these specifications is to establish quality required; there is no attempt to limit competitive bidding, but, in like manner, the quality specified will be rigidly maintained.

2. The words "approved", "equal to", "as directed". etc., are interpreted and will be taken to mean "to the satisfaction of the District."

D. UTILITIES (each of the following apply to this project as stated, unless otherwise noted in the project documents.)

1. Water - Existing service is available for the Contractor's use.

2. Electrical Service

   a. Existing service is available for the Contractor's use.

   b. The Contractor shall be responsible for furnishing necessary light bulbs, temporary lighting, temporary power stations, GFI outlets and extension cords as may be essential to the execution of their respective branches of the work. In addition, for extensions of lines to sheds or to power tools and remote areas which cannot be reached with extension cords.

   c. The Contractor shall be responsible for replacement cost of transformers, panels, circuit breakers and any other item of electrical equipment and installation thereof which is destroyed or broken as a result of or during the course of the Contractor's abatement activity.

3. Utility charges for electric power and water service will be paid by the Owner.

E. GUARANTEE

1. The Contractor shall, in case of work performed by his Subcontractors and where guarantees are required, secure warranties from said Subcontractors and deliver copies of same to the District upon completion of the work and prior to final retention payment.

2. All portions of the work shall also be maintained in perfect condition during this period. Such written guarantees as may be requested shall be submitted in duplicate at the completion of the work. These will be supplementary to and not in any way canceling specific guarantees which apply to various portions of the work.

3. If, in the Contractor's opinion, any work that is called for in the specifications in such a manner as to make it impossible for him to produce and guarantee a first-class piece of work, he shall refer the same to the District in a timely manner before proceeding.

1.03 DEFINITIONS

A. GENERAL TERMINOLOGY FOR ASBESTOS ABATEMENT

1. Owner - Washoe County School District, hereinafter referred to as the Owner, or the District, or the authorized representative of the Owner, or the District's consultant.

2. Authorized Visitor - Any visitor to the site whose visit has been authorized by the District.

3. Asbestos - The term asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite. Materials are considered to contain asbestos if any amount of asbestos is present.

4. ACM - Asbestos-containing material(s).

5. Visible Asbestos - Visible Asbestos Containing Material

6. Abatement - Procedure to control fiber release from asbestos-containing building materials. Includes encapsulation, enclosure and removal.

7. Removal - All herein specified procedures necessary to strip all ACM from the designated areas and to dispose of these materials at an acceptable site. **The preferred method of removal of flooring material mastic is by wet method utilizing a chemical mastic remover.**

8. Work Area - A room or location in which ACM is indicated to be removed by this Contract.

9. Containment Area - A work area or zone which is prepared with plastic sheeting, barriers, negative air, etc., for asbestos abatement work.

10. Enclosure - All herein specified procedures necessary to completely enclose all ACM behind airtight, impermeable, permanent barriers.

11. Encapsulation - All herein specified procedures necessary to treat ACM with an encapsulant to control the possible release of asbestos fibers into the ambient air.

12. Encapsulant (Sealant) - A liquid material which can be applied to ACM and which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant). Any encapsulant installed must be compatible with any new products that will installed over the encapsulate such as flooring products.

13. Air Monitoring (Air Sampling) - The process of measuring the fiber content of a specific volume of air in a stated period of time.

14. Area Monitoring - Air monitoring of fiber concentrations within the asbestos control area and outside the asbestos control area which is representative of the ambient airborne concentration of fibers.

15. Personal Monitoring - Air monitoring of fiber concentrations within the breathing zone of an employee.

16. HEPA Filter - A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of particles greater than 0.3 micron in size.

17. Negative Air Pressure System - A local exhaust system capable of maintaining a minimum pressure differential of minus 0.03 inch of water gauge in work area relative to adjacent areas. Documentation of negative air pressure is mandatory.

18. Negative Air Machine (NAM, "HOG") - A self-contained local exhaust machine utilized in a negative air pressure system. This equipment must use HEPA filters when used in asbestos work areas to collect and retain asbestos fibers.

19. HEPA Filter Equipment - Vacuuming equipment, which uses HEPA filters capable of collecting and retaining asbestos fibers. Filters shall be of 99.97% efficiency for retaining fibers of 0.3 micron or larger in size.

20. Surfactant - A chemical wetting agent added to water to improve penetration.

21. Amended Water - water to which a surfactant has been added.

22. Removal Encapsulate - a penetrating encapsulate specifically designed for removal of asbestos-containing materials rather than for on site encapsulation.

23. Chemical Remover - A pre-mixed chemical-penetrating agent designed specifically for removal of asbestos-containing material.

24. Airlock - A system for permitting ingress or egress without permitting air movement between a contaminated area and an uncontaminated area, typically consisting of two curtained doorways.

25. Curtained Doorway - Device to allow ingress or egress from one room to another while permitting minimal air movement between the rooms

26. Decontamination Facilities - A series of connected rooms, with doorways between any two adjacent rooms, for the decontamination of workers or of materials and equipment. The facility minimally consists of a clean room, a shower room, and an equipment room.

27. Clean Room - An uncontaminated area or room, which is part of the worker decontamination facility, with provisions for storage or workers' street clothes and clean or unused protective equipment.

28. Shower Room - A room between the clean room and the equipment room in the worker decontamination facility, with hot and cold running water, soap, shampoo, and suitably arranged for complete showering during decontamination.

29. Equipment Room - A contaminated area or room that is part of the worker decontamination facility, with provisions for storage of contaminated clothing and equipment.

30. Wet Cleaning - The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as asbestos-contaminated waste.

31. Water Filtration System - A local water-filtering system capable of trapping and retaining 99.9% of asbestos fibers greater than 5 micron in size.

32. Fixed Object - A unit of equipment or furniture in the work area which is not removed from the work area. To include chalk boards, bulletin boards, TV stands etc.

33. Movable Object - A unit of equipment or furniture in the work area, which can be feasibly removed from the work area without disassembly.

34. MSDS - Material Safety Data Sheet - OSHA Form 20 or equivalent form containing health hazard information about chemical products.

35. NESHAPS - The National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).

36. NIOSH - National Institute for Occupational Safety and Health.

37. OSHA - Occupational Safety and Health Administration.

38. EPA - Environmental Protection Agency.

39. ASTM - American Society for Testing and Materials.

40. ULI - Underwriters Laboratories, Inc.

41. Chemical Mastic Remover - A non-flammable solvent manufactured especially for the removal of mastic materials. **The flash point of the mastic remover used on District projects must be no less than 140 degrees Fahrenheit**.

PART 2 - APPLICABLE STANDARDS AND GUIDELINES

2.01 REFERENCE DOCUMENTS AND RESOURCES

A. All work covered by these regulations shall be performed in accordance with all applicable federal, state, and local regulations, standards, and codes governing asbestos abatement, transportation, and disposal. The current issue of each document shall govern. Where conflict among requirements or with these specifications, the more stringent requirements shall apply. Requirement shall include but not be limited to:

B. Department of Transportation

- Title 49 CFR 172 – Special Provisions, Hazardous Materials Communications, Emergency Response Information and Training requirements.
- Title 49 CFR 173 – General Requirements for Shipments and Packaging.

C. Environmental Protection Agency (EPA)

- Title 40 CFR, Part 763, Asbestos Containing Materials in Schools (AHERA)
- Title 40 CFR 61, Subparts A & M – National Emission Standard for Asbestos (Neshaps)
- Title 40 CFR, Part 763 – Revised Model Accreditation Plan

D. Federal Occupational Safety and Health Administration (OSHA)

- Title 29 CFR 1910.20 – Access to Employee Exposure and Medical Records
- Title 29 CFR 1910.38 – Emergency Procedures
- Title 29 CFR 1910.134 – Respiratory Protection
- Title 29 CFR 1926.20 – General Safety and Health Provisions
- Title 29 CFR 1926.21 – Safety Training and Education
- Title 29 CFR 1926.23 – First Aids
- Title 29 CFR 1926.24 – Fire Protection
- Title 29 CFR 1926.25 – Housekeeping
- Title 29 CFR 1926.28 – Personal Protective Equipment
- Title 29 CFR 1926.51(f) – Washing Facilities
- Title 29 CFR 1926.55 – Gases, Vapors, Fumes, Dusts, and Mists
- Title 29 CFR 1926.56 – Illumination
- Title 29 CFR 1926.57 – Ventilation
- Title 29 CFR 1926.59 – Hazard Communication Standard
- Title 29 CFR 1926.103 – Respiratory Protection
- Title 29 CFR 1926.300, 301, 302 – Hand and Power Tools
- Title 29 CFR 1926.451 – Scaffolding
- Title 29 CFR 1926.500, 502, 503 – Fall Protection
- Title 29 CFR 1926.1101 – Asbestos Standard for the Construction Industry

E. Nevada Division of Environmental Protection (NDEP)

- NAC 444.965 to 444.976 – Sanitation of Asbestos

F. Nevada Occupational Safety and Health Enforcement Section (OSHES)

- NAC 618.850 to 618.907 – Abatement of Asbestos, General Provisions
- NAC 618.910 to 618.948 – Abatement of Asbestos, Licensing and Accreditation to Perform Services
- NAC 618.950 to 618.962 – Abatement of Asbestos, Performance of Activities for Abatement
- NAC 618.970 to 618.986 – Abatement of Asbestos, Disciplinary Action

G. Washoe County District Health Department, Environmental Health Services Division. (WCHD)

- 030107A to 030.107C – District Board of Health Regulations Governing Air Quality Management (regarding asbestos)
- 030.184 to 030.185 - District Board of Health Regulations Governing Solid Waste Management

H. STATE AND LOCAL REQUIREMENTS

1. The Contractor shall comply with the State of Nevada, Division of Occupational Safety and Health Regulations for construction and handling of asbestos. All Contractor personnel will have the applicable Nevada OSHES card on their person at all times during the completion of the project. Personnel will be required to present the license to District personnel upon request. Personnel without their Nevada OSHES card, or with unreadable or mutilated cards, or expired cards will not be allowed to work on the project until a readable, unexpired card is produced.

2. The Contractor shall comply with the Federal Environmental Protection Regulations pertaining to handling and disposal of asbestos-containing materials as well as the State of Nevada and any local governmental agencies which have delegated responsibility for the administration and enforcement of NESHAPS and other federal regulations.

3. The Contractor shall comply with all requirements of the EPA approved landfill which is selected as the disposal site.

I. OTHER REQUIREMENTS

- ANSI - American National Standards Institute: ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems.

J. The Contractor shall comply with said regulations, requirements, and standards (noted in B through I) and require and be directly responsible for compliance therewith on the part of his agents, employees, and subcontractors; and shall directly receive and be responsible for all citations, assessments, fines or penalties which may be incurred by reason of his agents, employees, or subcontractors failing to so comply.

PART 3 - REQUIRED DOCUMENTATION

3.01 SUBMITTALS AND NOTICES

A. PRIOR TO COMMENCEMENT OF WORK, ALL THE FOLLOWING MUST BE SUBMITTED TO THE WCSD, ES&A DEPARTMENT

1. Notification in writing of proposed asbestos work, with copy to the WCSD, ES&A Department, the EPA Regional Office, OSHA or OSHA Regional Office, local air pollution agency, and local authority with responsibility for enforcement of occupational health and safety regulations and enforcement of NESHAPS regulations and with jurisdiction in the State in which this project is located, not fewer than ten (10) working days before work commences on this project. Courtesy notifications will be submitted on **all** projects regardless of the regulatory requirement.

2. Submit proof satisfactory to the WCSD, ES&A Department that all required permits, site locations, and arrangements for transport and disposal of asbestos-containing materials, supplies and the like have been obtained.

3. Submit documentation to the WCSD, ES&A Department indicating that all employees have had medical examinations (See Section 02110, PART 3, 3.01, B, 6) and instruction on the hazards of asbestos exposure, use of protective clothing, on use of showers, on entry and exit from work areas, on work procedures and protective measures, and on all aspects of 29 CFR 1910.134 (See also Section 02130, PARTS 3 and 4).

4. Submit documentation to the WCSD, ES&A Department that fifty (50) percent of the work force (exclusive of job foremen, superintendents, etc.) have at least one year's experience in asbestos abatement work for any employee not already approved and verified.

5. Submit to the WCSD, ES&A Department documentation that all superintendents, and supervisors have been certified as supervisors for at least two (2) year's and possess two (2) years' experience supervising asbestos abatement projects in that capacity for any employee not already approved and verified.

6. Submit documentation that **all** of the work force members are licensed by the State of Nevada in the field of asbestos control. Personnel will be required to present the license to District personnel upon request. Personnel without their Nevada OSHES card, with unreadable or mutilated cards, or expired cards will not be allowed to work on the project until a readable unexpired card is produced.

7. Submit documentation that each negative air machine and HEPA vacuums have been "thermally DOP tested" by a "third party" testing agency within a 6 month period prior to the start of each project. The "third party" testing must be conducted by a testing agency with its own testing equipment and may have no relationship with the contractor. The District's decision regarding the issue of when a testing agency meets the "third party"

requirement will be regarded as final and conclusive. The Contractor will be required to submit DOP test result certification for each unit prior to its use. The DOP testing company will be required to strictly comply with the manufacture procedures and testing media. The District may require access to review the DOP testing conducted during the contract period**. Any negative air machine or vacuums that are to be exhausted outside of a negative pressure enclosure must be DOP tested on-site prior to the start of any project. In addition equipment inside a containment larger than 2000 square feet will require on-site DOP testing of all negative air machines and vacuums prior to the start of the project.** Contractor will be required to add this delay for DOP testing into the project schedule and supplement the workforce accordingly to maintain the required abatement schedule.

8. Submit documentation that each negative air recording device (manometer) has been calibrated within 12 months prior to the start of each project.

9. Various manufacturers' information, including MSDS's, for approval, prior to its use on any project. In addition to submitting a copy to the ES&A department, Contractors will also be required to provide to the site's administration office and the Site Coordinator (head custodian) one complete copy of all MSDS's for all chemicals used on site.

10. Proof of insurance coverage prior to the start of each project.

11. Submit documentation from the Contractors asbestos liability insurance company, information on all area and personal area monitoring requirements. A complete copy of the insurance policy including any riders must be provided.

12. Submit documentation to the District indicating that all employees have taken the required AHERA training for the type of work they will be performing. Legible copies of each employee's initial training class and copies of the most recent refresher must be submitted. All employees will be required to have in their possession when performing abatement work the original copies of the initial training and refresher training certificates. District inspectors will review certificates in the field. Personnel without their AHERA training certificates, with unreadable or mutilated certificates, or expired certificates will not be allowed to work on the project until a readable initial or unexpired refresher certificate is produced.

B. The following procedure is to be implemented in an effort to reduce the time and cost to submit worker/employee training certs, Nevada State license, and physical documentation, items #3, #6 and #12 listed above. The required compliance will reduce the time the Contractor must put forth submitting training/physical documents as well as reduce the time it takes to review and approve the documents submitted. Contractors **will not** submit duplicate documentation to the ES&A department or representatives in the field that the ES&A department already has on file. Contractor can request a complete list of documents the ES&A department has on-file by calling the ES&A department at 851-5675 and one will be provided.

1. **<u>At least two weeks prior to the start of the project</u>**, contractor shall provide all worker/employee training certs and physical documentation for employees not already in the WCSD training database, to the ES&A Department at 7495 South Virginia Street, Reno, Nevada. To do this electronic copies will be provided through e-mail to the ES&A department Administrative Secretary. Contact the ES&A department Administrative Secretary. At 851-5675 if you do not their e-mail address. The ES&A Department will review the submitted training documentation and pre-approve workers and supervisors so they can work on the assigned WCSD project.

2. New workers added to the project after the start of the project will be approved by the ES&A department within one 8 hour period of the standard Monday thru Friday normal work schedule. Certification submittal will be serviced by the ES&A Department on a first come, first served basis. Delays to review the documentation will be anticipated and taken into account on any project schedule developed.

3. Workers or technicians will not report to the job site until they have been added to the ES&A database and properly documented on the contractors training report which is provided to ES&A or lead supervisory consulting staff in the field. ny way that requires certification on that project.

4. Contractors should request and will be provided a copy of the most current WCSD Company Training Report for their company which will identify training and physical documentation on file with WCSD for each employee. This database should be kept current by perspective bidders by providing to the ES&A department any new documentation when it is received for their employee so no delays are encountered due to a contactor not keeping this companies documentation current. Do not wait till you get a bid to provide updated data for your employees otherwise delays can occur.

5. ES&A staff in the field or environmental lead consulting staff will not be allowed to let anyone work or show up to the job site of they are not up to date on their documentation as identified on the WCSD Company Training Report.

C. The Contractor shall submit to the WCSD, ES&A Department, upon request, any other information the District may require, including, but not limited to, the following:

1. Weekly work schedule.
2. Type and brands of materials for worker protection.
3. Method of application and materials to be used.
4. Medical examination results of all employees (OSHA 1910.1001), including chest roentgenogram, pulmonary function and forced expiratory volume at one second (Contractor is responsible for obtaining the appropriate medical releases).
5. Schedule for changing filters in negative air pressure system and water filtration system.
6. Copies of all OSHA Form 101 or equivalent accident/injury/incident reports.

D. The Contractor shall submit directly to the WCSD, ES&A Department, **not Capital Projects Construction personnel**, or the Districts Consultant, upon each jobs completion And prior to final invoice submittal, a complete original documents job package including the following, **this is in addition to any other contract required documentation or documentation requested by others like asbestos consultants:**

1. Asbestos Removal Certification Letter signed and dated by the Contractors representative with language certifying that all asbestos materials have been properly removed in accordance with all Federal, State and Local regulations.
2. Asbestos insurance certificates
3. Manometer documentation that records air pressure differential between work areas and external air).
3. Copies of all daily manpower, work logs, and containment sign in logs indicating area(s) and type of work performed.
4. An original copy of all certifications of disposal.
5. Copies of permits.
6. Copy of the submitted notifications or courtesy notifications
7. Personal air sampling logs and an original air sampling results of each personal air sample taken on the project. The submitted log and sample results must include all the required data listed under air monitoring, Section 02120, part 2 of the technical specifications on page 23 and 24. The submittal of all personal sampling data identified above is in addition to the submittal of daily sample logs.

E. It is the Districts intention that the Contractors are responsible for supplying to the WCSD ES&A Department all Contractor generated documents. WCSD District-hired asbestos abatement consultants will be required to supply the following documents as a minimum, to the WCSD ES&A Department, at the end of the project and prior to final billing. The cost for development and submittal of the following is to be included in the asbestos consulting cost estimates provided to WCSD. Any costs for asbestos consultants to gather and/or submit a duplications of Contractor items listed above is not to be added to the Consultant's cost estimate. The District will not pay for this service twice, as the document submission of Contractor documents will be included in a Contractor's bid.

1. Summary letter explaining what was done, with a certification statement that observed work was done in accordance with Contract Specifications.

2. Drawing identifying what was done with post abatement notes, with information as required to identify all abatement work done.

3. Consultant's Daily logs documenting what was done, notes and narratives of the daily progress of the Contractor, and the steps taken to enforce contract specifications. Important project milestones should be addressed, as well in these daily logs, and pictures are encouraged.

4. Clearance air sampling maps identifying the outline of the abatement containment, date that the samples were taken, times that pumps were turned on and off, and flow measurements for each set of clearance air samples.

5. Copy of each clearance air sample laboratory chain of custody forms.

6. A copy of each clearance air sample laboratory results.

7. Area air sampling maps identifying the location samples were taken, date that the samples were taken, times that pumps were turned on and off, and flow measurements for each set of area air samples.

8. Copy of each area air sample laboratory chain of custody forms.

9. A copy of each area air sample laboratory results.

10. Bulk sampling map(s) identifying the locations any bulk samples were taken (if applicable).

11. Copy of any bulk sample laboratory chain of custody forms (if applicable).

12. A copy of each bulk sample laboratory results (if applicable).

F. The Contractor will submit daily by fax or e-mail to the WCSD, ES&A Department a copy of a daily air monitoring log with the numbers of all air monitoring cassette taken that day and the location taken or activity conducted by the personnel wearing the sample. A copy of each projects sample logs will not be acceptable. The daily sampling data listed above must be combined from all projects and listed on one daily air-monitoring log.

G. The Contractor shall have his laboratory e-mail or fax within **48 hours** of the date the sample was taken final laboratory result documents for air monitoring to the WCSD, ES&A Department. No hand written result report will be allowed. The laboratory reports will reference the air monitoring cassette's factory assigned number and the personal air monitoring results must be properly applied to an 8 hour time weighted average. Failure to submit results within the required 72 hour period may result in the District temporarily stopping the applicable abatement projects until results are received. Continued failure may also result in the termination of this contract.

H. The contractor may only invoice for a percentage of the project as agreed upon by the WCSD Project Manager & Contractor at the completion of work. but prior to submitting the final complete job package to the WCSD, ES&A Department at the Contrator discretion. The remaining agreed upon % may not be invoiced, and will not be authorized for payment until a complete job package has been submitted to the WCSD, ES&A Department and the completed package has been reviewed for correctness and accepted and all restoration of damage has been completed.

I. The Contractor will submit **daily** by fax or e-mail to the WCSD, ES&A Department an activity log with the location that contractor conducted activities that day, with a complete listing of workers assigned to each project.

J. Upon submittal, job packages will be reviewed for completeness by the WCSD, ES&A Department. In the event that a job package must be returned more than once, due to omissions or corrections, the contractor shall deduct a $200.00 processing fee from the projects final invoice, one fee per each occurrence after the first that the WCSD ES&A Department, district consultant or WCSD project Manager must contact the contractor due to omissions or errors.

PART 4 - SPECIAL PROCEDURES

4.01 ACCEPTANCE CRITERIA

A. Before any building or section of any building can be occupied by any personnel without respiratory protection, the level of airborne fibers must be less than or equal to the AHERA clearance level.

B. After the final cleaning, projects will be cleared by laboratory analysis of 5 air monitoring cassettes taken by the Owner, or Owner representative, inside the containment using aggressive methods. The analysis of cassettes from projects under 160 square feet will be analyzed by Phase Contrast Microscopy (PCM), NIOSH 7400. Projects over 160 square feet will analyzed by Transmission Electron Microscopy (TEM). Acceptable clearance levels for PCM analysis is all samples must be less than or equal to .01 fibers/cc. The Acceptable clearance level for TEM analysis is the average of the 5 samples taken inside the containment must be equal to or less than 70 asbestos structures per square millimeter. Fiber levels outside of the containment **cannot** be deducted from samples inside the containment to meet clearance criteria. It is the Contractor's responsibility to filter make-up air if so deemed necessary. Failure to filter a containments make up air will not relieve the Contractor from reimbursing the District for additional clearance samples that exceed clearance levels and fibers from outside the containment are suspected.

C. In the event that the initial clearance samples do not meet with the above protocol for air sampling clearance, the Contractor shall bear all costs required to perform additional sampling.

D. The District or Districts hired asbestos consultant will only perform as many air clearances as time allows. All attempts will be made to accommodate all requested requests for air clearance but the Contractor will be required to anticipate this requirement. Any delays or equipment tie ups due to the Contractors requiring more clearance samples then time allows on any given District work day is solely the responsibility of the Contractors and no additional fees will be paid to the contractor by the District. The Contractor will be required to have enough equipment available to maintain the required schedule in spite of any delays due the contractor requiring more samples then time allows. Locations requiring clearance sampling must be scheduled with the District one (1) day in advance by mail or fax. The containment must be ready for clearance sampling by 12:00 PM or earlier the day the samples are scheduled to be taken or the samples will be taken the next day. Contractor will anticipate an up to a 48 hour delay in receiving from the District TEM laboratory results.

4.02 STOPPING THE WORK

A. If, at any time, the WCSD, ES&A Department decides that work practices are violating pertinent provisions of the Contract, endangering workers, innocent bystanders, or endangering District facilities, they will immediately notify the Contractor in writing that operations shall cease until corrective action is taken and the Contractor shall take such corrective action before proceeding with the work.

B. If, at any time, the negative air pressure system is not operating in compliance with Sections 02120, PART 3, 3.02 and 02140, PART 1, 1.01H, and/or units are non-operational, operations shall cease until corrective action is taken and the Contractor shall take such corrective action before proceeding with the work.

C. Delays caused by inappropriate work practices as noted in 4.02A or 4.02B (Section 02110, PART 4) and/or excessive airborne fiber concentrations (defined as concentrations in excess of 0.2 fibers/cc, TWA) shall be at the Contractor's expense. No later claims for extra compensation which result from action taken under 4.02A, 4.02B or 4.02C (Section 02110, PART 4), or other delays caused by the Contractor failure to comply this Contract specifications will be recognized by the District.

D. In case of disagreement between the District and the Contractor regarding the analysis of any air monitoring data, either personal or area, the results of the District will be regarded as final and conclusive.

4.03 SITE SECURITY

A. The work area is to be restricted only to authorized, trained, and protected personnel. These may include the Contractor's employees, employees of subcontractors, District employees and representatives, State and local inspectors and any other designated individuals. The Contractor is responsible to ensure that the security of the building is not diminished and install all outside negative air machine exhaust ports in a secure manner. Failure to provide adequate security measures will leave the Contractor responsible to loss or damage of property if it is determined that access was gained through an inadequate security measure employed by the Contractor. A list of authorized personnel shall be established prior to job start and posted in the clean room of the worker decontamination facility and in the Contractor's office. The Contractor will not restrict access to District asbestos personnel to any asbestos containment at any time.

1. Contractor shall be notified by the District of any other authorized visitors prior to their entry to the job site.

B. Entry into the work area by unauthorized individuals shall be reported immediately to the District by the Contractor.

C. A log sheet shall be maintained in the clean-room area of the worker decontamination system or Contractor's office. Anyone who enters the work area must record name, affiliation, time in, and time out for each entry (See Section 02140, PART 1, 1.04G).

D. Should any keys that have been signed out to the Contractor become lost and cannot be found, the Contractor may be responsible for all cost associated with re-keying all locks at the site that the lost key opened.

4.04 EMERGENCY PLANNING

A. Emergency planning and procedures shall be developed by the Contractor prior to abatement initiation and agreed to by the Contractor and District.

B. Emergency procedures shall be in written form and prominently posted in the clean change area and equipment room of the worker decontamination area. All employees must read and sign these procedures to acknowledge receipt and understanding of work site layout, location of emergency exits and emergency procedures.

C. Emergencies may arise during the progress of work which may require special effort or require extra shifts of personnel to continue the work beyond the normal working hours. Be prepared in case of such emergency to do all necessary work promptly, at no additional cost to the District.

D. The Contractor shall file with District the names, addresses and telephone numbers of local personnel who can be contacted at any time in case of emergency. These persons must be fully authorized and equipped to correct unsafe conditions on short notice.

E. The Contractor shall provide the District with means to contact the Contractor or his representative, available 24 hours a day, in the case of emergencies while asbestos projects are in progress. Acceptable means would be a home or office phone plus a cell phone or beeper for when the Contractor is out of the home or office. Vehicle phone will not be acceptable. If the Contractor assigns this responsibility to one of his employees, the employee must have authorization and the ability to perform any emergency response requested.

4.05 PRE-CONSTRUCTION MEETING

A. The Contractor shall attend as specified a pre-construction job meeting at a time agreed upon by the Contractor and the District. Attending this meeting will be representatives of the District who will actually participate in the District's asbestos project monitoring program. The preconstruction meeting may be held via the telephone at the District's option. This meeting may be waived at the Districts discretion.

B. At this meeting or prior to starting work, the Contractor shall provide all submittals as required in Section 02110, PART 3. They shall be prepared to discuss the following information:

1. Preparation of work area.
2. Personal protective equipment including respiratory protection and protective clothing.
3. Employees who will participate in the project, including delineation of experience, training, and assigned responsibilities during the project.
4. Decontamination procedures for personnel, work area and equipment.
5. Abatement methods and procedures to be utilized.
6. Required air monitoring procedures.
7. Procedures for handling and disposing of waste materials.
8. Procedures for final decontamination and clean-up.
9. Detailed work and performance schedule.
10. Emergency procedures.

SECTION 02120

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 It should not be inferred that all materials, tools and equipment listed in Part 2 are required or that all required materials, tools and equipment necessary are listed herein.

PART 2 - MATERIALS

2.01 Deliver all materials in the original packages, containers or bundles bearing the name of the manufacturer, the brand name, and labeling as required by 29 CFR 1910.1200.

A. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.

B. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes contaminated with asbestos shall be disposed of in accordance with the applicable regulations.

2.02 Polyethylene sheeting of a **true** 4 mil and 6 mil thickness unless otherwise specified, clear in color and in sizes to minimize the frequency of joints. All Polyethylene sheeting will be **Fire retardant.**

2.03 Polyethylene bags, properly labeled, of a **true** 6 mil thickness, clear in color, for disposal of asbestos debris.

2.04 Tape - capable of sealing joints of adjacent sheets of plastic sheets and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under dry and wet conditions, including use of amended water, chemical removers, or removal encapsulant.

2.05 Surfactant (wetting agent) - shall consist of 50% polyoxyethlene ester and 50% polyoxyethlene ether, or equivalent and shall be mixed with water to provide a concentration of 1.25 kg/cubic meter of water.

2.06 Chemical Remover - suitable to aid in removal of ACM such as EPA 55 or equivalent.

2.07 Removal Encapsulant - suitable to aid in removal of ACM such as Asbestite 1000, Serpiflex Shield #4, BWE 5000, or equivalent; the removal encapsulant shall act as its own solvent and be capable of binding and encapsulating individual asbestos fibers.

2.08 Impermeable containers (Drums) - suitable to receive and retain any asbestos-containing or contaminated materials until disposal at an approved site. (The containers shall be labeled in accordance with OSHA Regulations 29 CFR 1910.1001).

2.09 Warning labels and signs - as required by Regulation.

2.10 Encapsulant - Penetrating type, such as Asbestite 2000, American Coatings' Cable Coating 22p, SK 13-1C, BWE 3000, or equivalent. The encapsulant should have a coverage of 80 square feet per gallon and shall be compatible with new applications of flooring mastic. The encapsulant **must** be **clear** in color.

2.11 Encapsulant - Bridging type, such as American Coating FNE High Temperature Sealant, Ocean 666, or equivalent. Bridging encapsulant shall have a coverage of 25 square feet per gallon. Any encapsulant installed must be compatible with any new products that will installed over the encapsulate such as flooring products.

2.12 Spray Poly - Spray applied water resistant film with minimum coverage of 16 mil thickness when wet, such as Isotek Spray Poly or equivalent.

2.13 Other Materials - provide all other materials as specified in drawings; also, other materials such as lumber, nails, and hardware, which may be required to construct and dismantle the decontamination area and the barriers that isolate the work area.

2.14 Chemical Mastic Remover - A non-flammable solvent manufactured especially for the removal of mastic materials such as Control Low Odor, Sentinel 747, or equivalent. The flash point shall be no less than 140 degrees Fahrenheit.

PART 3 - TOOLS AND EQUIPMENT

3.01 Provide suitable tools for asbestos removal. The minimum acceptable amount of equipment to support this contract is estimated at 4 recording manometers, 4 standard incline manometers, 4 shower and water filter units, and twenty four 1500 cfm negative air units. This is an estimate of the minimum equipment and additional equipment may be required to comply with Contract Specifications and Documents.

A. If the Contractor is unable to keep up with the requested work schedule due to the lack of required equipment or inoperable equipment, the District reserves the right to purchase or rent equipment which will then be supplied to the Contractor. The Contractor will then be responsible to reimburse the District for the cost associated with the rental or procurement. The District would only exercise this option in the event the Contractor fails to take reasonable steps on his own to repair his own equipment or rent or procure equipment necessary to keep up with the requested schedule.

B. Under no circumstance will contaminated tools or equipment, be placed inside of a District room outside of a containment. Contaminated tools and equipment will be sealed in impermeable plastic bags (minimum of six-mil think) and **immediately** transported into the containment from the transporting vehicle directly into a containment that has already had its critical barriers completed and is under negative pressure. This includes equipment or tools that is placed in bags or sealed in plastic.

3.02 Negative Air Pressure System - a negative pressure must be established in the work area by means of a local exhaust system. The equipment shall exhaust through a **three** or more stage HEPA filtration system to the outside of the work area. The equipment shall be in operation for 24 hours per day until decontamination and final clean-up of the work area is completed. A recording device shall be used to provide documentation of the pressure differential of 0.03 inches of water gauge. The system shall have the following additional characteristics:

A. Filtration equipment in compliance with ANSI Z9.2, Local Exhaust Ventilation.

B. Capable of maintaining a minimum pressure differential of minus 0.05 inch of water gauge in the work area relative to adjacent areas. The 0.05 inch of water gauge requirement must be maintained throughout the removal process including the waste load out and during the entrance and exit of the containment through the Decon. It is suggested that this is considered when calculating the negative air requirements of each containment.

C. Negative air pressure system units shall be employed in sufficient quantity to provide no less than **eight** (**8**) air changes per hour in the work area.

D. Negative pressure units **must** be exhausted to the outside of the building through a reinforced **Owner** approved opening. In the event a window or door to the outside is removed, the opening installed will be vandal proof and not reduce the security of the building. As a minimum, when a window or door is removed, the contractor must install a plug constructed of 1/2" plywood. The plug must be larger than the hole and secured inside the opening with two or more wood 2 x 4s installed crosswise and secured with 3/8" tamper proof bolts.

E. **Pre-fabricated** metal reinforced exhaust tube will be utilized to exhaust all negative air machines. The exhaust tubing utilized must be the same size throughout the exhaust run and the same size as the negative air machine exhaust port. Continuous runs of tubing without splices are required for runs less than twenty-five feet (25'). The Pre-fabricated exhaust tubes will be replaced at the first signs of wear. Contaminated, taped or damaged tubes will not be allowed to be used. The Districts decision regarding when an exhaust tube requires replacement will be regarded as final and conclusive.

F. At the discretion of the Owner and at no extra cost the contractor may be required to install an extension to the negative air exhaust tube where it exits a containment. The extension will be constructed of metal reinforced exhaust tubing. Typically the extension would extend from the plug to a point on the roof determined by the District inspector.

G. The negative air machine exhaust tubing will be routed as per the direction of the District inspector. The routing of the negative air machine exhaust tubing through rooms not included in the containment will not be allowed unless there are no exterior windows or doors present inside the containment area. In the case of inoperable windows, Contractors will be required to hire a window company or perform the work themselves to remove and properly re-install inoperable windows as required so the negative air machine exhaust tubing is routed through windows. Only the WCSD ES&A department AHERA Project Designer certified staff are allowed to sign off on any instance, where a negative air machine tube is routed through a room that is not a part of the asbestos abatement containment area, instead of using a window or other exterior openings. No exceptions and Contractors must bid accordingly.

3.03 Water Filtration System - Water used for showering in the decontamination area and any other asbestos-contaminated water must be filtered prior to disposal as waste water. The system shall contain at a minimum a three-stage filtering system with the following additional characteristic:

A. Capable of trapping and retaining 99.9% of asbestos fibers greater than 3 microns in size.

B. All water systems equipment to include showers and filter systems will comply with all (including the District's) applicable backflow/cross connection prevention requirements. The District will enforce all backflow/cross connection prevention requirements

3.04 Airless Pump - Encapsulant, if spray-applied, shall be applied with an airless pump in order to minimize fiber dispersion during the decontamination process. The tip shall have an orifice of .019 to .026 or as required by the manufacturer of the encapsulant selected for use.

3.05 Type "C" Supplied Air System - A continuous flow or pressure-demand, supplied air respirator, NIOSH/MSHA certified or other suitable air filtration system, as required by OSHA regulations for performance of work of this nature, is suggested for all workers. Type "C" system shall have visual and audible alarms to warn of carbon monoxide levels in excess of 20 ppm. Such system shall meet all criteria prescribed by OSHA for supplied air respirators. It also must be fully certified for hose length combinations up to 300 feet. Either half-mask or full facepiece units fitted with HEPA filter back-up units are acceptable.

3.06 Temporary electrical cords and outlets shall be of an approved type and connected to a source of power outside of the work area as directed by the District (see Section 02140, 1.01). All temp power cords must be plugged into a ground fault interrupter equipped power source.

SECTION 02130

COMPLIANCE REQUIREMENTS

PART l - PERSONAL PROTECTION

1.01 RESPIRATORY PROTECTION

A. Provide workers with clean and properly maintained respiratory equipment approved by NIOSH/MSHA as specified in Section 02120, PART 3, 3.05. The Contractor must present documentation of no less than five (5) similar projects with personal sampling results indicating that employee exposure levels were at “clean air levels” (0.01 f/cc) inside the respirator. Half-mask air-purifying respirators equipped with high-efficiency particulate air (HEPA) filters may be utilized with written permission of the Owner. Initially, temporary approval for the use of half-mask respirators will be granted after receipt of the proof requested above. Continued authorization will be considered based thereafter on personal monitoring samples taken on projects completed under this contract. If the Contractor consistently maintains personal monitors levels at or below “clean air levels” (0.01 f/cc inside the respirator) on a 8 hour time weighted average, continued use of half-mask respirators will be authorized. Should the personal monitoring or area monitoring levels show the contractor is unable to maintain levels at the “clean air levels” (0.01 f/cc), inside the respirator, the half-mask authorization will be rescinded. Area or personnel monitoring level above 1.0 fibers/cc TWA will require that personnel utilize type "C" respiratory protection. The Contractor will be responsible for providing sample results that have been applied over the 8 hour time weighted average. When utilized, the Contractor shall provide a sufficient quantity of filters during the work day. The clean respirator filters shall be stored at the job site in the change room and shall be totally protected from exposure to asbestos prior to their use.site in the change room and shall be totally protected from exposure to asbestos prior to their use.

1. Single-use or disposable respirators will not be permitted at the job site.

2. Contractor shall also monitor and provide documentation indicating that the workers are properly protected against over exposure to any of the chemicals contained in the chemical mastic remover(s).

3. Additional air filter protection will be required when chemical solvents are used.

1.02 PROTECTIVE CLOTHING

A. Provide workers with sufficient sets of protective full-body clothing. Such clothing shall consist of full-body coveralls and headgear. Provide eye protection and hard hats as required by applicable safety regulations. Non-disposable type protective clothing and footwear shall be left

in the Contaminated Equipment Room until the end of the asbestos abatement work, at which time such items shall be disposed of as asbestos waste, or shall be thoroughly cleaned of all asbestos or asbestos-containing material. Disposable type protective clothing, headgear, and footwear may be used and shall be disposed of as asbestos waste. Bare feet will not be permitted.

1.03 WORKER PROTECTION PROCEDURES

A. Each worker shall, upon entering the job site: Remove street clothes in the clean change room, put on a respirator and clean protective clothing before entering the equipment room or work area, except that workers intending to rewear contaminated protective clothing stored in the equipment room shall enter equipment room wearing respirators.

B. Each worker shall, each time he leaves the work area: Remove gross contamination from clothing before leaving the work area; proceed to the equipment room and remove all clothing except respirators; still wearing the respirator, proceed to the showers; clean the outside of the respirator with soap and water while showering; remove the respirator; thoroughly shampoo and wash themselves, remove filters (where required) and place them in the container provided for the purpose; and wash and rinse the inside of the respirator.

C. Following showering, each worker shall proceed directly to the clean change room and dress in clean clothes at the end of each day's work, or before eating, smoking or drinking. Before re-entering the work area from the clean change room, each worker and authorized visitor shall put on a clean respirator with filters (where required) and shall dress in clean protective clothing, except that workers intending to rewear contaminated protective clothing stored in the equipment room shall enter the equipment room wearing respirators.

D. Contaminated work footwear shall be stored in the equipment room when not in use in the work area. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from equipment and access area. Store contaminated protective clothing in the equipment room for reuse or place in receptacles for disposal with other asbestos contaminated materials.

E. Workers shall not eat, drink, smoke or chew gum or tobacco, or utilize sanitary (toilet) facilities at the worksite except in established locations outside the work and containment areas, and enclosures.

F. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbances of asbestos-containing or contaminated materials and until final clean-up is completed. This includes removal of fixtures, ceilings, or anything else which may disturb the ACM.

PART 2 - AIR MONITORING

2.01 Throughout the removal and subsequent cleaning operations AMBIENT (AREA) MONITORING may be conducted by the District to ensure that the Contractor is complying with all regulations and is conducting the work in a manner which minimizes airborne asbestos levels as well as minimizes the contamination of the District's facilities.

A. The Contractor is responsible to complete all regulatory required area monitoring and all area monitoring that is required by the Contractors liability insurance company.

2.02 Throughout the removal and subsequent cleaning operations, PERSONAL AIR MONITORING shall be conducted by the Contractor. Such samples shall be taken in order to establish an 8-hour TWA (for example, a minimum time of 480 minutes at 2.0 lpm) and exposure for each type of employee operation. Analytical results of personal air samples shall be sent to the Districts ES&A Department and provided to the Districts asbestos consultant on a 72 hour turn-around basis. Electronic PDF final reports shall be e-mailed directly to the District ES&A department directly from the Contractor's laboratory. Personal monitoring will be conducted on 50% of the workers. The workers shall wear personal monitoring devices, and all sampling will be conducted in each workers breathing zone only. Asbestos Consultants hired by WCSD, and supervising asbestos abatement projects, are required to strictly enforce these Personal Air Monitoring requirements, so Contractors must plan accordingly. Failure for the Contractor to provide air sampling results within 72 hours requires that the District's consultant supervising the project must stop the job. No exceptions. To that end, District Consultants must monitor the situation and provide the Contractor a written 24 hours notification, after 48 hours that results have not been received. After these 24 hours have transpired, the Consultant must stop the job awaiting submittal of required sampling results. No exceptions.

A. For each set of air samples submitted to a laboratory by the Contractor for analysis, the Contractor shall submit a blank cassette for analysis (minimum of 10 percent). Each blank cassette shall be submitted as a part of the Contractor's quality control program.

B. Any PCM air sample submitted by the Contractor for analysis shall be to an independent laboratory currently enrolled in the AIHA/NIOSH proficiency Analytical Testing (PAT) program.

C. The Contractor shall use factory pre-numbered air monitoring cassettes and note each cassette's numbers on the daily log or a separate monitoring cassette log. The number on each cassette shall be recorded **PRIOR** to use. Each cassette's number will also be listed on the laboratory analysis request form and also be referenced on the Laboratory sample analysis report. A copy of the daily log or separate monitoring cassette log will be e-mailed to the ES&A department **and** the District's asbestos consultant **daily** for all projects in progress. Asbestos Consultants hired by WCSD and supervising asbestos abatement projects are required to strictly enforce these requirements so they must monitor and document this process as a part of the Consultants project monitoring process.

D. Daily project personal air sample logs must be kept and submitted. As a minimum the sample log must include, date sample taken, air flow measurements taken at the start and finish of the sampling duration, time started and stopped, the factory assigned cassette number, employee sampled, and the activity of the employee. Legible sample logs will be submitted in the completed job package along with an original laboratory analysis report. Consultants hired by WCSD and supervising asbestos abatement projects are required to strictly enforce these requirements so they must monitor and document this process as a part of the Consultants project monitoring process.

E. A credit of $25.00 per sample will be deducted from the Contractors final invoice for each documented case, that a required sample per contract specifications (50% of the workforce is NOT monitored) was not taken or submitted for analysis. In addition, this credit will also apply to samples that were not taken properly or the data required by contract specifications is not provided. Consultants hired by WCSD and supervising asbestos abatement projects are required to strictly enforce these requirements so they must monitor and document this process as a part of the Consultants project monitoring process.

PART 3 - SUPPORT ACTIVITIES AND PERSONNEL

3.01 TRAINING

A. Training by a EPA accredited training provider shall be provided by the Contractor to **all** employees or agents or subcontractors who may be required to disturb asbestos-containing or asbestos-contaminated materials for abatement and auxiliary purposes and to all Contractor supervisory personnel who may be involved in planning, execution, or inspection of abatement projects. **No on-line training certificates for Lead or Asbestos training will be accepted.**

B. Training shall provide, at a minimum, information on the following topics:

1. The health hazards of asbestos including the nature of various asbestos related diseases, routes or exposure, known dose-response relationships, the synergistic relationship between asbestos exposure and cigarette smoking, latency periods for disease and health basis for standards.

2. The physical characteristics of asbestos including fiber size, aerodynamic properties, physical appearance and uses.

3. Employee personal protective equipment including the types and characteristics of respirator classes, limitations of respirators, proper selection, inspection, donning, use, maintenance and storage of respirators, field testing the facepiece-to-face seal (positive and negative pressure fitting tests), qualitative and quantitative fit testing procedures,

variations between laboratory and field fit factors, factors that affect respirator fit (e.g., facial hair), selection and use of disposable clothing, non-skid shoes, gloves, eye protection, and hard hats.

4. Medical monitoring requirements for workers including required and recommended tests, reasons for medical monitoring, and employee access to records.

5. Air monitoring procedures and requirements for workers including description of equipment and procedures, reasons for monitoring, types of samples, and current standards with recommended changes.

6. Work practices for asbestos abatement including purpose, proper construction and maintenance of plastic barriers, job set-up of airlocks, worker decontamination systems and waste transfer airlocks, posting of warning signs, engineering controls, electrical and ventilation system lockout, proper working techniques, waste cleanup, and storage and disposal procedures.

7. Personal hygiene including entry and exit procedures for the work area, use of showers and prohibition of eating, drinking, smoking, and chewing in the work area.

8. Special safety hazards that may be encountered including electrical hazards, air contaminants (CO, wetting agents, encapsulant, materials from Owner's operation), fire and explosion hazards, scaffold and ladder hazards, slippery surfaces, confined spaces, heat stress, and noise.

9. Workshops affording both supervisory personnel and abatement workers the opportunity to see (and experience) the construction of containment barriers and decontamination facilities.

C. Training is to have occurred within 12 months prior to the initiation of abatement activities.

D. Contractor must document training by providing date(s) of training, training entity, course outline, and names and qualifications of trainers.

E. Submit documentation to the District indicating that all employees have taken the required AHERA training for the type of work they will be performing per Section 02110, Part 3, 3.01, B, of these specifications.

F. An employee of the Contractor or subcontractor who is deemed incompetent, disorderly, or otherwise objectionable by the Owner, shall be removed promptly by the Contractor, and not re-employed on the work. Any employee of the Contractor that is observed that is not utilizing his personal protective equipment will be immediately removed from a project and not allowed on any other District projects. Should any disagreements result regarding the identification of the employee or his/her proper use of personal protective equipment, the determination of the District AHERA Program Supervisor/ Technicians or District hired Consultant will be considered final and

conclusive. The Contractors Asbestos Abatement Supervisors who allow employees to not utilize their personal protective equipment will be immediately removed from a project and not allowed on any other District projects. Contractors will be required to replace removed employees/Supervisors and no additional time will be allowed to complete the project.

PART 4 - MEDICAL MONITORING

A. Medical monitoring must be provided by the Contractor to any employee or agent that may be exposed to asbestos in excess of background levels during any phase of the abatement project. The purposes of a medical monitoring program, in addition to meeting the requirements of the law, are to document the state of health of workers for workers' compensation and to determine work relatedness of disease as well as to ensure fitness for duty, particularly ability to wear a respirator. Smokers should be made aware of the synergistic effects of cigarette smoking and asbestos exposure. The medical monitoring program provides the appropriate setting to share this information. Employers should also be aware of the potential cost of this additional risk. Medical monitoring shall include at a minimum the requirements of OSHA 29 CFR 1910.1001 (1).

1. A work/medical history to elicit symptomatology of respiratory disease (see CFR 1910.1001), Appendix D, Medical Questionnaires).

2. A chest X-ray (posterior-anterior, 14 x 17 inches) taken by a certified radiology technician and evaluated by a certified B-reader.

3. A pulmonary function test, including forced vital capacity (FVC) and forced expiratory volume at one second (FEV.), and FEV/FVC ratio (administered by a NIOSH or A.T.S. Certified Pulmonary Technician and interpreted and compared to standardized normals by a Board Certified Occupational Physician or Pulmonary Specialist).

4. Employees shall be given the opportunity to be evaluated by a physician to determine their capability to work safely while breathing through the added resistance of a respirator. (Examining physicians shall be aware of the nature of respiratory protective devices and their contributions to breathing resistance. They shall also be informed of the specific types of respirators the employees shall be required to wear and the work they will be required to perform, as well as special workplace conditions such as high temperatures, high humidity, and chemical contaminants to which they may be exposed. Evaluation of groups of workers should take into consideration epidemiologic principals as suggested by the American Thoracic Society in their statement on the work relatedness of disease adopted in 1982).

SECTION 02140

EXECUTION

PART 1 - PREPARATION

1.01 WORK AREA;

A. The following procedures are to be utilized to establish a work area and containments for all projects except mini work areas and mini-containments;

1. Shut down electrical power as necessary. When and where required, provide temporary power and lighting and ensure safe installation of temporary power sources and equipment per applicable electrical code requirements and provide safety lighting and ground fault interrupter circuits as power source for electrical equipment.

2. Shut down and isolate heating, cooling, ventilating air systems to prevent contamination and fiber dispersal to other areas of the structure. During the work, vents or openings within the work area shall be sealed with tape and at least 2 layers of 6 mil poly sheeting.

3. As directed by the District, pre-clean fixed objects within the proposed work areas using HEPA filtered vacuum equipment and wet cleaning methods, and enclose all fixed objects with a minimum of clear 6 mil plastic sheeting sealed with tape. This is in addition to the splash protection layer specified in item F below. All edges of the 6 mil will sealed with duct tape.

4. As directed by the District, pre-clean the proposed work areas using HEPA-filtered vacuum equipment and wet cleaning methods. Methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters shall not be used. Failure to pre-clean may increase the nuisance fiber level inside the containment and thereby raise personal monitoring results.

5. Seal off all openings with critical barriers, including, but not limited to, windows, corridors, doorways, skylights, duct, grille, or diffuser openings and any other penetrations of the work areas, with clear 6 mil plastic sheeting sealed with tape. Doorways, windows and corridors which will not be used for passage during work must be sealed with two layers of 6 mil plastic barriers. Doors and windows can be taped around the edges and then covered with one layer of clear 6 mil plastic to achieve the two layer requirement. Any opening that requires support such as hallways or large opening or other large criticals must be supported with 2x4 studs, 24 inches on center

6. All doors will be left in place unless approved by the ES&A Director. Doors are much more secure than plastic critical which is why these will not allowed to be removed. If there is tile/mastic under the door in the door opening the following is the only procedure that will be allowed. The contractor shall create the entire containment except for sealing the doors that have tile under them. The containment and negative air will be in place and running and the containment, other than the doors will have been inspected and

approved. Once this has happened, the contractor shall have a worker don proper personal protective equipment (PPE) and then do a spot abatement in the area under the door using manual methods. The worker shall complete spot abatement under the door and the door will be secured and sealed per #5 above. No abatement shall take place inside the containment, other than doorway spot abatement. The number of doorways that can be spot abated at one time will be no more than two at a time.

7. If the Contractor is removing asbestos containing materials, and the flooring material within the containment is not identified for abatement, cover floor surfaces with at least 2 layers of 6 ml poly. Use a minimum of two layers of clear 6 mil poly. Cover the floor **first** so that the 2 layers of plastic that extends at least 12 inches up on the walls. Depending on the material of the roof and its practicality of being wet wiped the Owner may require that one clear layer of 4 or 6 mil plastic layer be installed for a ceiling.

8. Cover wall surfaces with plastic sheeting sealed with tape. Use a minimum of one (1) clear layer of 4 mil plastic on walls. Cover walls so that the plastic extends eight (8) feet above the area of work. Seams should overlap a minimum of six (6) inches.

9. Build airlocks at entrances to and exits from the work area. Airlocks should be built in a manner which allows for in-flow air. The installation of air locks which restrict the air flow of make-up air through the Decon will not be permitted. Additional make-up air, if required to achieve eight (8) air changes, shall be admitted through specially constructed vents which prevent contaminated air from leaving the work area.

10. Contractor may be required to install one clear layer of 4 or 6 mil plastic layer for a ceiling in the containment depending upon the ceilings construction, asbestos design considerations, and its air permeability and the ability to maintain negative pressure inside the containment.

11. Establish negative air pressure system which produces no less than eight (8) air changes per hour in the work area and maintains a pressure differential of 0.05 inch water gauge between the inside and outside of the work area. The location and identification of each individual negative air unit shall be provided to the District for each work area. The District, as certified Project managers reserves the right to direct the contractor to relocate the negative air machines. Identification (for example, labels) shall be clearly visible in the work area and at the unit's exhaust location.

12. The Contractor shall provide two manometers, located as directed by the Owner. The first manometer shall be a continuous printout type with an adjustable set-point audible alarm. The alarm may not be deactivated. The second shall be a standard inclined manometer, Dwyer Model 250.5 AF or approved equal.

13. As directed by the District, remove and clean ceiling or wall mounted objects, such as lights and other items not previously sealed off, that interferes with asbestos abatement. Use localized water spraying or HEPA filtered vacuum equipment during fixture removal to reduce the fiber dispersal.

14. Maintain emergency and fire exits from the work areas, or establish adequately marked alternative exits satisfactory to the District. The contractor will have on site before the start of the project a fire extinguisher and first aid kit.

15. The Contractor shall place a job board with all MSDS, emergency numbers (24 Hour), safety procedures, air monitoring results, etc., at an accessible location to employees and visitors. The job board may be placed in the clean room overnight if the entrance to a containment is outside and the board's security is in question.

16. Contractor shall provide a clear 18" x 18" plexi-glass view windows at locations designated by the Owner. Contractor will add or move viewing windows at any time throughout the project at the Owners request. View windows will never be covered once installed.

17. Use smoke methods to test effectiveness of barriers and the negative pressure system when directed by the District.

B. The following procedures shall be utilized to establish a work area and mini-containment for small scale/short duration projects. The Owner shall determine if a mini-containment is more practical or cost affective then the containment of the entire room space;

1. Prior to the construction of the mini-containment enclosure, the Contractor will consult with the Owner and receive Owner approval of the containments proposed design prior to the start of a mini-containment enclosure.

2. Contractor shall construct a 2 layer, clear 6 mil poly enclosure with walls, a roof and a floor. The containment will be supported by means of wooden studs, PVC pipe, or other rigid materials. It will be sufficiently supported to ensure that negative pressure will not damage the containment. It will be large enough to ensure the material can be removed without puncturing the containment.

3. Negative pressure inside the mini-containment will be provided by a small adjustable flow negative air machine. All mini-containments will require negative pressure and a HEPA vacuum cleaner will not be allowed to provide negative pressure except in very small mini-containments and only with prior written approval of the Owner.

4. A two cell decontamination enclosure shall be installed to provide access to the containment and serve as a decontamination enclosure. Air-locks shall be installed at the entrance to the decontamination cell and the abatement containment. Minimum size of the decontamination enclosure shall be six feet high by 5 feet wide.

5. Waste load-out and double bagging will be accomplished in the decontamination enclosure.

6. All other provisions of these contract documents and specifications apply to mini-containment enclosures except for the modification to the work area, decontamination enclosure and waste load-out addressed in 1 thru 4 above.

C. The following procedures shall be utilized to establish a work area and perform abatement for windows and window sealant abatement. The following window procedure will be utilized to remove the window frame with possible asbestos containing putty, and asbestos containing window sealant (Caulking) from WCSD window openings.

1. From the inside of the school, inside of each classroom install Plywood ½" over the window opening. Install 2 layers of 6-mil polyethylene plastic (poly) on the exterior surface of the plywood, to assist with clean up of the plywood surface prior to installation of the plywood. After the plywood is installed, install 2 layers of 6 mil poly over the interior surface extending out past the edge of the plywood, and attach with tape in an adequate fashion to completely seal off the exterior window opening from the inside of the building. The removal cannot proceed until an airtight poly seal has been created between the inside and the outside of the window opening. This contractor will not be able to proceed with any removal until District's ES&A personnel or District's asbestos consultant approves the prep of each window. This will be documented in the contractor's daily log and initialed by the District's ES&A personnel or the District's asbestos consultant.

2. Washoe County Health Department personnel can be expected to visit the abatement site. The contractor will be required to cooperate and comply with all WCHD requests.

3. Isolate the HVAC for the entire wing or area being abated, prior to the start of abatement.

4. It may be necessary to isolate the wings adjacent to the building being abated, based upon the discretion of the District's ES&A personnel or assigned asbestos consultant.

5. Install 6-mil poly drop that extends out at least 20'out and adjacent from each window opening. If any window debris leaves the poly drop area, the contractor will be required to HEPA vacuum the ground as directed by the District's ES&A personnel or the District's asbestos consultant.

6. Place safety tape to isolate the area of the broken window from the public. At least 50 ' has to be isolated. Contractor will need to ensure that only abatement workers or the District's ES&A personnel or the District's asbestos consultant enter this area during abatement. No personnel or school staff will be allowed to work on the same side of the school wing when abatement activates are taking place. If a wing is directly across from the abatement activity that wings classrooms on the side of the abatement cannot be occupied.

7. As needed, use a glasscutter to score the inside of window glass to ease with glass removal. **A power tool cannot be used** for the removal of the window frame. Hand tool may be utilized.

8. As needed, remove glass by tapping on scored part of glass breaking it out, remove all glass present except the pieces behind putty. This makes it easier and safer to remove the frame without the glass being in the way.

9. Damage to and disturbance to the putty and sealant should be limited to the extent possible, and removed as intact as possible.

10. Pick up and dispose of the glass, asbestos debris and frame, in contractor's vehicle or dumpster for transport for proper asbestos disposal at a remote site. Do not dispose of debris in the District dumpster.

11. From the outside, clean up the internal area of the window frame, ledge and window jamb up to the poly window opening seal of any debris. The block opening will need to scraped, so that no sealant material is left behind before the window frame will pass a visual clearance, conducted by the District's ES&A personnel or the District's asbestos consultant. HEPA vacuum all areas of abatement surfaces, including the inside of the window opening prior to requesting a visual clearance.

12. When the window frame has been completely removed and the removal passes a visual clearance conducted by the District's ES&A personnel or District's asbestos consultant, carefully roll up the exterior poly drop that is on the ground, with the debris in it, and dispose at a remote location as asbestos waste. Do not dispose of any window poly/debris in the District dumpster.

13. Spray on encapsulate will be sprayed onto the window opening and poly surface of the plywood on the exterior side of the window opening.

14. Air Quality Air Samples may be taken once a wing is completed inside a number of the classrooms inside the wings by the District's ES&A personnel or the District's asbestos consultant and analyzed by TEM analysis. No personnel except the District's ES&A personnel or the District's asbestos consultant properly protected will be allowed inside the building being abated prior to receiving air sampling results or visual clearance. The plywood on the window openings will be left in place, and secured until air-sampling results or a visual clearance is received from the District's ES&A personnel or the District's asbestos consultant.

15. The window replacement contractor can work in the window opening, once the removal has passed a visual clearance, but cannot enter the area of demarcation or work on the same side of a building, while abatement is being conducted. Once abatement activities have been completed for the day, the replacement contractor could then work on that side of the building until abatement activities are resumed.

1.02 DECONTAMINATION ENCLOSURE SYSTEM AND WASTE LOAD-OUT AREA

A. Construct a worker decontamination enclosure system contiguous to the work area as follows:

1. The decontamination enclosure shall be constructed of two layers of 6 mil poly sealed with tape. At the discretion of the Owner the contractor may be required to construct a decontamination enclosure outside of the building. The exterior Decon shall be constructed with a minimum of 2x4 studs 24 inches on center and 1/2 inch plywood and to a standard which insures the security of the building. The outside chamber shall have a solid lockable door that shall remain locked whenever the Contractor is not on site. A key will be given to the Owner. The location of any decontamination enclosures will be determined by the Owner.

2. An equipment or dirty room with two doorways, one to the work area and one to the shower room. Pop-up Decon chambers typically will not be approved for use by the District. The use of Pop- up Decon Chambers will be reviewed on a case by case basis and the District reserves the right to require that they not be used.

3. A **metal** shower room with two doorways, one to the equipment room and one to the clean room. The shower room shall contain at least one shower with hot and cold water. Careful attention shall be paid to the shower enclosure to ensure against leaking of any kind. Ensure a supply of soap and shampoo at all times in the shower room. Clean and dry towels shall be available for employees and owner-authorized visitors and personnel. A three-stage water filtration system must be employed prior to release of shower water into the local sewage system. The shower must comply with all applicable backflow prevention/cross connection requirements including the Districts. Any shower or water device that does not meet the minimum air gap requirement will have to be fitted with the appropriate backflow prevention device. Proof of the required testing of any employed backflow prevention assembly will be required. Non-metal pop up showers are not acceptable.

4. A clean room with one doorway into the shower and one entrance or exit to non-contaminated areas of the building or outside. The clean room shall have sufficient space for storage of the workers' street clothes, towels and other non-contaminated items. Individual lockers shall be available to workers within the clean room. Pop-up Decon chambers typically will not be approved for use by the District. The use of Pop- up Decon Chambers will be reviewed on a case by case basis and the District reserves the right to require that they not be used.

B. As directed by the District, construct using (2) two layer of 6 mil. Poly, a waste load-out area contiguous to the work area which is utilized for transportation of ACM to a landfill.

1. The decontamination enclosure may only be used as a waste load out area with Owner approval, and only when it exits to the exterior of a building and there are no other exterior doors inside the containment. All waste load out activities will be accomplished through a waste load out enclosure exiting an exterior door whenever one is available.

The Decontamination enclosure will only be considered for use as a waste load out enclosure when all other avenues of exit are not deemed practical by the Owner.

1.03 MAINTENANCE OF ENCLOSURE SYSTEMS:

A. Ensure that barriers and plastic linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

B. Visually inspect enclosures and negative air units at the beginning of each work period or shift. Details of the inspections are to be included in the Contractor's daily log. The contractor will be required to note the manometer readings of the containment in the daily log at the start and end of the shift and every 1/2 hour while on the job site. **The Contractor will be required to inspect containments at locations that are awaiting final clearance sampling results twice daily, once in the morning and once late in the afternoon before the building is scheduled to be locked up.**

C. Use smoke methods to test effectiveness of barriers and the negative air pressure system when directed by the District.

1.04 ASBESTOS REMOVAL WORK SHALL NOT COMMENCE UNTIL;

A. Arrangements have been made for disposal of waste at an acceptable site.

B. Arrangements have been made for containing and/or disposal of waste water resulting from showering and other abatement activities.

C. Work areas, decontamination enclosure system, and waste load-out area are effectively segregated.

D. Tools, equipment and material waste receptacles are on-site.

E. The Type "C" supplied air respirator system(s) or other approved air filtration system is (are) on-site and fully operative, when required by the District.

F. All other preparatory steps have been taken and applicable notices posted and permits obtained.

G. A visitor and employee log-in/log-out system is in place at the job site. All persons entering the site will be required to sign-in and sign-out.

H. Plexi-glass view windows have been installed in all locations requested by the Owner.

I. The containment has been inspected and written approval has been given by the Owner.

PART 2 - ASBESTOS REMOVAL

2.01 ORDER OF OPERATIONS

A. In general, work shall progress in the following order of operations; this listing is not provided to suggest that abatement sequences or additional requirements may not be required of the Asbestos Abatement Contractor to comply with regulatory requirements depending on the specific nature of each particular asbestos abatement projects:

1. Site preparations (See Section 02140, PART 1).

2. Removal of all asbestos debris and contaminated fixtures from the work site.

4. Rough clean and remove all remaining asbestos debris.

5. Detail clean and removal all asbestos containing asbestos debris and residual asbestos contaminants.

4. Encapsulate all areas from which asbestos was removed. Any encapsulant installed must be compatible with any new products that will installed over the encapsulate such as flooring products. Encapsulation will be done prior to taking air clearance samples or after air samples have been sampled to ensure that the project encapsulation activity complies with Nevada regulations. (See Section 02140, Part 2, 2.03)

5. Clean up site (See Section 02140, PART 2, 2.04).

6. Remove final (splash protection) layer of polyethylene sheeting from walls.

7. Nothing in Section 02140, PART 2, 2.01 is meant to supersede the inspection procedures noted in Section 02150, PART 2.

2.02 REMOVAL PROCEDURES

A. Floor covering may be removed physically, mechanically, or chemically. The work may include the abatement of asbestos containing material (ACM) on floors. New flooring materials will be installed over abatement areas so mastic removal techniques employed by the abatement contractor are to be done so that installed flooring products are able to be warranted by the flooring manufactures. If the abatement contractor is being hired by a flooring contractor the abatement contractor must consult the flooring installer and ensure their employed removal techniques do not void any warranties for new installed products. It is quite possible that chemical mastic removers may not be able to be utilized to achieve this requirements. No power tools may be utilized to remove flooring materials. As feasible, all removal shall be conducted using wet methods to reduce the release of fibers. If chemical mastic removers are used, follow

the manufacturers recommended procedures.

B. Remove the asbestos material in small sections. As it is removed, pack the wetted material in impermeable plastic bags (2) of 6 mil minimum thickness. Plastic waste bags will be then placed into waste containers prior to removal from the abatement area. Material shall not be allowed to leak out or dry out prior to insertion into the containers.

1. Contractor shall adhere to disposal authorities' size and weight requirements for containers (bags or packages).

2. All ACM or asbestos-contaminated material that has been removed shall be bagged at the end of each work shift (that is, debris on the floor cannot be allowed to accumulate).

3. All ACM or asbestos-contaminated material which has been bagged or wrapped in the work area cannot be allowed to accumulate; all bagged or wrapped material must be placed in the dumpster after every shift.

C. Remove bagged or wrapped material to waste load-out area. Re-bag or re-wrap all material in a second impermeable 6 mil bag or second 6 mil layer of plastic, respectively and then place into a waste container, except carpet rolls. Clean external surfaces of bags by wet sponging prior to being put into the waste container. The exterior of the containers shall be wet wiped inside the waste load out decon and place caution labels on containers in accordance with OSHA regulation 29 CFR 1926.58. **No abatement activities may be taking place inside the containment during waste load out. The decon shall be sealed up during waste load out.** Egress through the decon shall take place prior to or after waste load out.

1. **Under no circumstance will waste bags or containers be allowed to be stored inside a building.** The waste will be removed from the containment and **immediately** be transported outside the building and placed into the waste disposal receptacle.

D. In the event that no work is performed in a given area for any period which exceeds thirty-six (36) hours, all visible ACM on the plastic walls and all bagged and containered ACM or asbestos-contaminated material shall be locked and secured in the dumpster. If the amount of material exceeds the storage capacity of the dumpster, all material must be properly disposed of at the landfill prior to that 36-hour, non-work period.

E. The chemical mastic remover(s) shall be used in accordance with the manufacturer's directions at all times. Due to the combustible nature of chemical mastic removers, the District reserves the right to limit the amount of mastic remover used at any one time.

2.03 ENCAPSULATION PROCEDURES:

A. On friable asbestos abatement projects, the State of Nevada requires that air clearance samples be taken prior to encapultaion. Contractors will take direction from the District ES&A personnel

or District hired asbestos consultant to determine if encapsdulation will be done prior to taking air clearance samples or after air samples have been sampled to ensure that the project encapsulation activity complies with Nevada regulations. Prior to air clearance sampling or after and upon approval by the Owner, either Contractor shall apply a penetrating encapsulant to bind any remaining non-visible asbestos fibers; encapsulant shall be applied according to manufacturer's directions. Contractor shall submit product information for prior approval by the District.

B. The encapsulant shall be clear in color. Any encapsulant installed must be compatible with any new products that will installed over the encapsulate such as flooring products.

2.04 CLEAN-UP

A. Remove all visible accumulations of asbestos material and debris. Wet clean all surfaces within the work area.

B. The windows, doors, and HVAC vents shall remain sealed and any HEPA filtered negative air pressure systems, waste load-out, and decontamination enclosure systems shall remain in service.

1. All equipment used in the work area shall be included in the clean-up and shall be removed from work areas via the decontamination enclosure system or waste load-out, at appropriate times in the cleaning sequence.

2. **Under no circumstances will contaminated materials, tools or equipment that has been removed from the containment be allowed to be placed inside a building outside containment.** All items will be **immediately** transported to a lockable storage unit or placed inside a Contractor's vehicle. Items will also not be allowed to accumulate outside of a building.

C. As directed by the District, clean all remaining surfaces in the work area (including the HVAC system, see Section 02160) and any other contaminated areas with water and with HEPA filtered vacuum equipment. After cleaning the work area, wait an appropriate period of time to allow for settlement of dust, and again wet clean a second time and clean with HEPA filtered vacuum equipment all surfaces in the work area. After completion of the second cleaning operation, perform a complete visual inspection of the work area to ensure that the work area is free of visible asbestos debris.

1. If the District, after the second cleaning finds visible accumulations of asbestos debris in the work area, the Contractor shall repeat the wet cleaning until the work area is in compliance, all at the Contractor's expense.

2. Wet clean as necessary.

3. Remove splash guards as directed by the District.

4. Nothing in this section is meant to relieve the Contractor of his responsibility to meet the

final clean criteria as established by these contract documents or any other applicable laws or regulations.

D. When a final inspection determines that the work area is free of accumulations of visible asbestos debris, and fiber levels continue to remain at or below .010 fibers/cc the District will proceed with the final TEM clearance sampling (see criteria as set forth in Section 02110, PART 4, 4.01).

E. WHEN CLEAN-UP IS COMPLETE, AFTER AIR CLEARANCE IS RECEIVED;

1. Remove final polyethylene barriers from windows, doors, corridors, and so on; remove negative air pressure system from area.

2. Relocate objects moved to temporary locations in the course of the work to their former positions.

3. Where applicable, establish HVAC, mechanical and electrical systems in proper working order. Install new filters, furnished by the Owner, and dispose of used filters as asbestos-contaminated waste.

4. When more than one work or containment area is required, install new clean barriers (6 mil plastic or better) to separate adjoining areas.

5. Contractor shall mop the abatement area floor with two coats of a product that will remove any residue but does not void and product being installed over the abatement areas such as flooring materials. Additional coats of clear water will then be mopped onto the floor until the product utilized to do the final wash residue is removed.

2.05 DISPOSAL

A. As the work progresses, and to prevent exceeding available dumpster storage capacity on site, remove asbestos waste and dispose of such at an authorized disposal site in accordance with the requirements of the disposal authority. Submit documentation regarding disposal to the District. Contractor is responsible for all costs regarding waste including waste characterization sampling.

1. All ACM or asbestos-contaminated material must be double-bagged (or wrapped) in 6 mil bags and then placed into a waste container (drum). All materials that are generated from the asbestos containment must be disposed of as asbestos waste to include the poly containment materials or any other materials used to create the containment that are present inside or with surfaces that are inside the containment.

2. All ACM or asbestos-contaminated material must be damp when delivered to the disposal site.

3. **Under no circumstance will waste bags or containers be allowed to be stored inside a building.** The waste will be removed from the containment and **immediately** be transported outside the building and placed into the waste disposal receptacle.

4. Chemical mastic remover will be separated from the asbestos waste and disposed of in accordance with all applicable regulations. It is the Contractors responsibility to determine the proper disposal based upon the type and amount of mastic remover.

5. All waste load out activities will be scheduled for and inspected by the Owner.

B. Sealed plastic bags may be dumped into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled.

C. Dumpsters or any EPA-approved hazardous waste container system capable of being totally secured can be used in lieu of drums for transport to the disposal site. Absolutely no uncovered, unlockable dumpsters will be allowed to be used as a waste container system. This includes dumpster for construction debris that is associated with an asbestos abatement project. Open dumpsters, vehicles or trailers with wood covering installed will not be allowed for use as a waste container system.

1. All loads are to be delivered in an enclosed vehicle. No open pick-ups will be allowed.

D. Each load must be accompanied by a Uniform Hazardous Waste Manifest (EPA Form-22) or equivalent and any other certificate required by State or local agencies.

1. Original copies of the Hazardous Waste Manifest shall be provided to the District.

SECTION 02150

WORK SCHEDULE AND INSPECTION PROCEDURES

PART 1 - WORK SCHEDULE

1.01 The work is to be carried out diligently to completion with utmost speed. The Contractor shall furnish to the District a final working schedule showing anticipated starting and completion dates for each removal zone or area. This schedule shall be furnished to the District within at least five (5) calendar days from issuance of the District's written Notice to Proceed.

1.02 If, in the opinion of the District, it becomes necessary to work additional men for maintaining the schedule and for the completion of any phase of the project within the specified time, the Contractor must immediately do so upon written request by the District.

1.03 Work shall proceed immediately upon receipt of Contractor's Notice to Proceed from the District. Facilities shall be available to the Contractor as agreed upon. All work must be completed no later than agreed upon.

PART 2 - INSPECTIONS BY THE DISTRICT

2.01 The District shall inspect the site preparation work within the building as outlined in Section 02140, PART 1 to ensure that the facility is adequately sealed off, the negative air pressure system is functioning properly, the decontamination enclosure system, and waste area are in place. The Contractor SHALL NOT PROCEED with the gross removal until such time as the District has inspected the site preparation work and given the Contractor a Notice to Proceed (PREP).

2.02 The District shall inspect the removal work and work area upon its completion within the building or section thereof to ensure that all visible ACM or asbestos-contaminated material has been removed. The Contractor SHALL NOT PROCEED with the next phase of the work or spray any materials on the building systems until such time as the District has inspected the facility and given the Contractor a Notice to Proceed (REMOVAL AND DETAIL).

2.03 After encapsulation, the District will inspect the adequacy of encapsulation within each building or section thereof. The Contractor SHALL NOT PROCEED with final clean-up until a Notice to Proceed has been issued (ENCAPSULATION).

2.04 The District will inspect the facilities on a daily basis as necessary to ensure compliance with this Contract. Representatives of the District may be on-site at all times during the performance of this Contract.

A. The District is not limited by the inspection requirements as noted above in Sections 2.01 through 2.03; additional safety and health inspections as well as inspections by the Owner will occur randomly. Contractor will not attempt to control access to asbestos containments to District asbestos personnel.

SECTION 02160

MECHANICAL

PART 1 - SCOPE OF WORK

1.01 Remove as directed all HVAC ventilation grilles and registers, including ceiling or wall access panels. Each shall be wet-cleaned and stored by the Contractor except those designated to be disposed of as asbestos waste. Or seal all grilles, registers, and ceiling or wall access panels in plastic sheeting.

1.02 Contractor will ensure that the all equipment has been properly locked out and all procedures to secure all equipment, including mechanical equipment, will comply with all requirements of the OSHA and the Districts Lock out/tag out procedures.

1.03 As directed by the District, during final cleaning, wet-clean and vacuum all HVAC ventilation ducts with HEPA filtered vacuum equipment.

A. Cleaning may include, but is not limited to, the first six feet of all supply, return and exhaust air ducts adjacent to the work area.

SECTION 02170

ELECTRICAL

PART l - SCOPE OF WORK

1.01 Disconnect all circuits in the work area at the main panel box and lock out same as approved by the District.

1.02 Where required, remove all existing electrical fixtures including, but not limited to, ceiling and wall lights, clocks, alarms, and sound system fixtures. Each shall be wet-cleaned, location tag attached and store as directed by the District.

A. Nonfunctional electrical fixtures or systems shall be brought to the attention of the District in writing prior to commencement of work. Failure to notify the District in writing of any nonfunctional electrical fixtures or systems will not act to relieve the Contractor of the provisions of Section 02170, PART 2, 2.04.

1.03 Protect all exposed wires.

1.04 Contractor will ensure that the all equipment has been properly locked out and all procedures to secure all equipment, including electrical equipment, will comply with all requirements of the OSHA and the Districts Lock out/tag out procedures.

SECTION 02180

RESTORATION

PART 1 - RESTORATION WORK

1.01 Existing conditions disturbed by the Contractor's operations shall be restored to a condition satisfactory to the District and shall match existing adjacent surfaces. Damage due to tape, staples, nails, spray-poly, water, including unforeseen actions, is the responsibility of the Contractor and must be restored to the prior to final acceptance of the facility by the District.

1.02 The Contractor shall survey and detail all existing damage to walls, floors and floor coverings, fixtures and so on. This survey shall be submitted to the District in writing prior to set-up and preparation of the worksite.

1.03 All restoration must be completed within two weeks after the abatement project containment is torn down. Failure to complete the restoration in the two week time frame will result in the District hiring an outside vendor to complete the restoration. The cost of services for the restoration will be deducted from the projects final payments or any payments outstanding to the contractor.

1.04 The contractor is responsible for supplying all labor and materials to properly perform the restoration.

1.05 The contractor is responsible for the security of items removed by the contractor that require reinstallation. The District assumes not responsibility for the security of items left in District facilities. The contractor is responsible for replacing at no cost to the District any item removed by the contractor that is found to be missing or damaged at the time of reinstallation.

PART 2 - WALL AND FLOOR COVERING

2.01 It is the Contractor's responsibility to ensure that all wall areas are adequately sealed with 6 mil plastic in order to prevent water accumulation and asbestos contamination. Any wall material which is stained or otherwise damaged during any phase of the work shall be replaced in its entirety with materials of equal quality and selected by the District.

2.02 The Contractor shall restore all painted, varnished, lacquered, paneled or enameled surfaces (including factory finished surfaces) should damage occur from tape, staples, nails, water, and so on. Should such procedures be unacceptable to the District, the District may require, at its option, the entire replacement, refinishing, repainting or resurfacing of the damaged surface area.

PART 3 - FIXTURES

3.01 Any electrical fixtures, HVAC grilles, registers, and access doors lost or damaged by the Contractor shall be replaced at Contractor's expense.

3.02 Any other fixtures, furniture, appliances, and equipment not specifically mentioned must be replaced or repaired at Contractor's expense if lost or damaged.

PART 4 - SEWER SYSTEM

4.01 Should the Contractor, his employees, or subcontractors utilize existing sewer facilities for disposal of any ACM, asbestos contaminated material, or asbestos contaminated water, Contractor shall thoroughly clean the entire building's sewage system including, but not limited to, all sink, shower, floor, and toilet drains and traps, all primary and secondary sewage lines, and all lines wherever located and extending underground to the main sewer service connection.

PART 5 - EXTERIOR OF BUILDING

5.01 It is the Contractor's responsibility to repair or replace any and all damaged external areas of the building including, but not limited to, walls, doors, sidewalks, driveways, parking lots, concrete curbs, shrubbery, grass, sprinkler systems, and so on.

A. Damaged areas will be repaired or replaced at the option of the District.

5.02 Any ground areas external to the building which may become contaminated with asbestos shall be decontaminated at the Contractor's expense.

A. Decontamination procedures shall require removal of dirt to a depth of 4 inches which shall be disposed of as asbestos waste.

B. All areas from which soil was decontaminated shall be restored to its original condition at the option of the District.

SECTION 02190

TRANSITE SUPPLEMENTAL SPECIFICATIONS

Asbestos Abatement Specifications
Washoe County School District
Transite Panels at District Sites

Background

Washoe County School District (WCSD) will be performing the abatement of transite wall, ceiling panels, pipes and/or window panels at various District sites. This supplemental spec as well as the District specs will apply to the removal of all transite materials. The abatement contractor shall be prepared to abate the transite materials as identified in the site-specific architectural drawings provided for the individual site or information provided prior to bidding.

The contractor will need to note when additional asbestos-containing materials are to be abated within the same containment area and perform that work within the same negative pressure enclosure, if applicable. The contractor's onsite supervisor, or project estimator during bidding, will need to confer with either WCSD or the District's independent third-party consultant, for the expected containment areas and number of containments at a particular site.

Scope of Work

The contractor awarded the project will be responsible for all costs associated with the abatement of the transite.

The project scope shall be determined by the site-specific architectural drawings prepared for the individual site. The Contractor is responsible for reviewing the architectural drawings and the WCSD Regulated Systems and Assessment (ES&A) Material Disturbance Permit to determine which materials, including any sealants, in the project area are asbestos-containing.

The District has retained an independent third-party abatement consultant to draft these specifications, who may provide oversight during the projects, conduct visual clearance inspections and collect clearance air samples at the conclusion of these abatement projects. All oversight or additional oversight and collection of air samples may be performed by the District's ES&A Department as well at their discretion.

In addition to complying with these supplemental specifications, the Contractor must also comply with all other asbestos abatement requirements listed in these asbestos abatement specifications. If Contractors find any conflicting information in the supplemental specifications, the Contractor must comply with the requirements listed herein that are deemed most stringent by the District or District hired asbestos consultant supervising the abatement.

Project Requirements

Contractor shall be approved by the WCSD ES&A Department to perform asbestos abatement activities within the District. **Approval of firms that have not performed activities impacting asbestos for the District previously, will need to submit all necessary documentation outlined in the WCSD ES&A Technical Specifications for the project at least ten (10) business days prior to work commencing for approval.**

All workers certifications – asbestos training and licensing and medical clearance – shall be submitted to the WCSD ES&A at least five (5) working days prior to project commencement at minimum for approval. Contractor is responsible for reviewing WCSD ES&A worker roster for the company to assure all workers to be used on the project have been approved prior to arrival onsite. Workers not identified on the approved worker list for the contractor will not be allowed to perform any activities onsite, even if documentation is provided onsite at time of the project commencement.

The abatement contractor's onsite supervisor shall have a copy of these Specifications onsite at all times and be familiar with the project requirements prior to arrival onsite at the project. Failure to follow requirements of these Specifications, or lack of knowledge of requirements to be followed during the project, are grounds for replacement of the abatement contractor's onsite supervisor.

Only the abatement contractor will be allowed to occupy the project area once abatement activities are scheduled to start. This applies to all WCSD non-ES&A staff/personnel and site staff/personnel. The area shall only be occupied by the abatement contractor, WCSD ES&A staff, and District's independent third-party abatement consultant. Other personnel will not be allowed to occupy the building during asbestos abatement activities.

Contractor shall adhere to the requirements of these Specifications, WCSD ES&A Technical Specifications, Federal, State, and Local regulations.

Water and Electricity

Water and electricity are available onsite, but long hoses and cords may be necessary. The contractor is responsible for any damage to water or power systems caused by their use of those systems.

Contractor shall provide a GFI at the primary plug-in of all electrical trains used for electrical equipment. Hose washers shall be provided at all hose connections to prevent leakage of water and potential damage to District facilities.

Pre-Cleaning

Pre-cleaning is not expected to be necessary; however, Contractor may need to remove some debris or clean surfaces to facilitate building containment area.

Notifications

Contractor is responsible for timely notifications (including courtesy notifications if applicable) to Nevada Division of Industrial Relations and Washoe County Health Department. Notifications shall be filed in advance of any waiting periods in lieu of the proposed project start date or other requirements for pre-work notification. Any revisions to notifications including project scope, start date, duration of project, or any other changes are the Contractor's responsibility. Valid notifications shall be posted onsite during the project, and copies shall be provided to the District's onsite third-party consultant.

Equipment

Contractor is responsible for providing all necessary equipment in sufficient quantities to complete the project in the schedule provided for the project. All equipment must arrive onsite clean and in proper functioning order. Any equipment that arrives onsite dirty or not in proper functioning order shall be removed from the project site for cleaning and/or repairs.

Training

Workers performing asbestos abatement activities as part of this project must have AHERA Worker training with at least one worker trained to the AHERA Contractor-Supervisor level. All workers shall be licensed by the Nevada DIR for asbestos work. The crew lead Contractor-Supervisor may not leave the site anytime asbestos abatement operations are being performed.

As noted previously, all workers certifications must be approved by the WCSD ES&A prior to arrival onsite to start work. Copies of the worker certs shall be provided to the District's onsite third-party consultant as well.

Personal Protection Equipment

The contractor is responsible for adhering to Nevada Division of Industrial Relations and OSHA requirements for worker respiratory protection. At a minimum, workers shall wear half-face, negative pressure respirators with HEPA (P-100) filters during any activities which disturb asbestos-containing materials.

Workers shall wear Tyvek-level disposable coveralls, hard hats, work gloves, and safety glasses (if not using a full face-piece respirator.) Street clothes may be worn under disposable coveralls.

All employees shall have a valid medical clearance and fit test for respirators to be used. Medical clearance shall be provided for approval to the WCSD ES&A prior to the project commencement. Copies of the medical clearance and fit test shall be provided to the District's onsite third-party consultant as well.

Personal Air Monitoring

The contractor is responsible for the collection of personal air samples on workers during all abatement activities for asbestos. Personal air samples shall be collected in accordance with OSHA sampling protocols and analyzed by a laboratory with the proper accreditation.

Laboratories to be used for personal air sample analysis must be approved by WCSD ES&A.

Copies of the personal air sampling results, along with laboratory accreditation, shall be submitted to the WCSD ES&A and District's independent third-party consultant.

In addition, the contractor will comply with all requirements regarding personal air monitoring listed in Section 02130, Part 2- - Air Monitoring, 2.02.

Security and Safety

The contractor is responsible for security of all equipment and safety of all employees. Contractor shall provide any storage containers or security needed for tools and equipment if needed.

Contractor is responsible for all worker safety and following all applicable regulations, namely Nevada and Federal OSHA, including for asbestos and respirable crystalline silica exposures.

Occupancy

As noted previously, the project area will be limited to the abatement contractor, WCSD ES&A staff, and District's independent third-party consultant once abatement activities are ready to commence. Once the area has been cleared, other parties may occupy.

Emergency services may also occupy areas in the event of an emergency during the project.

Challenge Testing

All HEPA-filtered equipment to be used on this project shall have been challenge tested (DOP or equivalent) within the previous 30 days prior to use onsite. Copies of the challenge testing results shall be provided to the WCSD ES&A and/or District's independent third-party consultant.

Asbestos Abatement Containment and Abatement Requirements

ALL POLY USED ON PROJECT SHALL BE 6-MIL AND FIRE-RETARDANT UNLESS EXEMPTED IN REQUIREMENTS BELOW.

WHERE POSSIBLE, TRANSITE PANELS SHALL BE REMOVED FROM THE EXTERIOR SIDE.

Interior Transite Panel Abatement

1. Contractor shall seal all critical barriers (HVAC, windows, doors, etc.) in each area with one layer of 6-mil poly. Doors leading outside of the containment area shall remain in place for security.

2. All walls, floors, and any fixed objects that cannot be removed from the containment shall be covered with one layer of 6-mil poly. An additional layer of 4-mil poly may be applied to covered surfaces for use as a cleaning barrier. Vertical barriers may be installed to decrease the size of containment areas; however, such barriers shall be constructed with wood framing and ½" plywood backing.

3. Poly critical barriers with wood framed ½" plywood backing shall be installed on the exterior side of the transite panel to contain the interior space and secure the wall opening. Two layers of poly shall be used to cover the plywood with an additional two layers installed on exterior side of the plywood which will extend out 2" on each side of the plywood.

4. A minimum three-stage decontamination unit with operable shower shall be contiguous with each containment. See "Decontamination Chamber Requirements" in this specification for further requirements.

5. Negative pressure shall be established and a recording manometer shall be attached to each containment. Copies of the manometer recordings shall be provided on 8.5"x11" paper by the Contractor.

6. An air pressure differential of -0.050" WC must be established and maintained throughout all phases of abatement and through receipt of passing air clearance.

7. Workers shall wet all materials prior to, and during, removal using amended water.

8. Transite panels shall be removed intact wherever possible.

9. Any sealants at edges of transite panels, or other suspect materials that may need to be disturbed by the transite panel removal shall be considered to be asbestos-containing materials unless sampled and proven otherwise.

10. Following removal of all transite panels, all poly shall be wet-wiped or HEPA-vacuumed clean as part of detail cleaning. Any 4-mil poly cleaning barriers may be removed as part of this detail cleaning.

11. All waste shall be placed into two separate waste bags of 6-mil thickness. The outer waste bag shall be sealed in a "goose-neck" fashion to create a leak-tight container.

Exterior Transite Panel Abatement

1. Contractor shall seal all critical barriers (HVAC, windows, doors, etc.) within 20 feet of the work area with one layer of 6-mil poly.

2. Poly drop sheets shall be installed in the work area, extending 20 feet out from any transite panel to be removed, and this work area shall be demarcated with warning signs / tape. The Contractor shall control access to this regulated area to a distance of 50 feet out, demarcating the perimeter with caution tape.

3. Poly critical barriers with wood framed ½" plywood backing shall be installed on the interior side of the transite panel to seal off the interior space and secure the wall opening. The plywood will be covered with two layers of 6-mil poly on both the interior and exterior side. The interior poly barriers shall extend out two inches on each side.

4. Decontamination facilities shall be sited adjacent to the work area, and shall include a drop sheet. A water source shall be provided, along with soap and towels. Dirty water shall be contained. A privacy barrier shall also be installed as needed.

5. Workers shall wet all materials prior to, and during, removal using amended water.

6. Transite panels shall be removed intact wherever possible.

7. Any sealants at edges of transite panels, or other suspect materials that may need to be disturbed by the transite panel removal shall be considered to be asbestos-containing materials unless sampled and proven otherwise.

8. Following removal of all transite panels, all poly shall be wet-wiped or HEPA-vacuumed clean as part of detail cleaning.

9. All waste shall be placed into two separate waste bags of 6-mil thickness. The outer waste bag shall be sealed in a "goose-neck" fashion to create a leak-tight container.

Decontamination Requirements

A three stage decon unit including a shower is required for any interior asbestos containments. Each chamber of the decon must have self-closing Z-flaps that seal air tight. A four-inch barrier must exist at the floor of each chamber to prevent the transfer of water and debris from chamber to chamber. This barrier will also provide a seal for the flaps between each chamber. Equipment and bag out chambers do not require a shower, but a washing station must exist and they must be three-stages. The washing station must be constructed in a manner that prevents water from splashing or traveling out of the central decon chamber. Equipment and bag out chambers must also have flaps that seal air tight.
Shower units must be equipped with an overflow pan to catch water which overfills the drain system, or is splashed out of the chamber during employee showers. Showers must be supplied with hot water, soap, shampoo, and towels for the workers. Showers shall be sited in the central decon chamber. Showers and washing station must also be equipped with a filtering system that includes a 0.5 micron filter. If filtering system is not available or is not functioning correctly, shower water must be bagged and disposed of as asbestos-containing waste.
All chambers of the decon, including the clean chamber, must be kept clean and dry (except shower) at all times. Abatement work will be stopped if decon is not kept in acceptable condition.

Regulated Area Signage
Asbestos Danger signs shall be posted at all entrances or exits to the containment area, even if the entrance or exit is sealed as a critical barrier. Signs shall also be posted on the flap leading into the shower station of

decontamination chambers. Signage will be set once a pre-start visual is passed and work may begin in the containment, but no work will start until all signs are posted.
Signage shall meet the revised requirements set forth in 29 CFR 1926.1101(k)(7).

Air Pressure Differential – Full Containment Areas Only

Air pressure differential must be established and maintained at -0.05 inches water differential or better before start of abatement and air pressure differential must be maintained through all phases of project, including collection of clearance air samples and receipt of results. A minimum of eight air changes per hour is required for the project. Work will be halted if the air pressure drops below -0.05 inches water differential and can resume when air pressure differential of -0.05 inches is established again.
Air pressure differential must be displayed and recorded on a properly calibrated and fully functioning manometer. Copies of the manometer recording must be provided by the contractor on 8.5" x 11" paper at completion of project.
All negative air machines must be exhausted to the exterior of the building using wire-reinforced flex duct. All negative air machines must be used inside containment. No machines shall be attached to the exterior of the containment with the intake only inside.
Any exterior or interior barricades need to be constructed of a minimum ½" plywood and shall be made secure.

Make-Up Air Sources

Available, but may need to be HEPA-filtered. Any make-up holes in critical barriers must be equipped with a challenge/DOP-tested HEPA filter. Placing a pre-filter in the make-up air hole will not be allowed.

Disposal Requirements

All asbestos waste generated on this project will need to be double-bagged in 6-mil poly waste bags, or double-wrapped in 6-mil polyethylene sheeting. All waste bags must be sealed in a “gooseneck” fashion and “burrito-wrapped” materials shall have staggered seams. All non-friable debris shall be properly labeled and identified for disposal as an asbestos-containing waste. Materials that have become friable or which removal methods have made friable shall be labeled and identified for disposal as regulated asbestos-containing material (RACM).

The contractor will need to provide a lockable waste bin for all waste created on this project. Waste bin will need to be labeled with asbestos signage once the waste is loaded into the bin. Waste bins shall be lined with one layer of 6-mil poly prior to waste being loaded.

Waste bins will need to arrive onsite clean of debris or any other waste and in proper functioning order. Waste bins may be rejected by WCSD ES&A staff or District’s independent third-party consultant if these conditions are not met, with no extra charge to the District.

Clearance

Upon completion of asbestos abatement activities, a final visual inspection will be performed by either WCSD ES&A staff or District's independent third-party consultant. This inspection will be performed only after the abatement contractor crew supervisor has performed their own final visual clearance. Areas must be free of all three-dimensional material with all surfaces clean of dust and debris and all materials abated within the containment area.

The visual inspection will serve as final clearance for exterior transite panel removal. Following a successful visual clearance inspection, the Contractor shall apply a lock-down encapsulant, then remove containment drop sheets, signage, equipment, etc. The barriers at window / wall openings shall be left in place.

For interior removal of transite panels within full containment, final clearance shall be through aggressive air sampling conducted by the District's independent third-party consultant. A set of five air samples will be collected inside the containment to be analyzed in accordance with AHERA completion of response action criteria using either phase contrast microscopy (PCM) or transmission electron microscopy (TEM), depending on the quantity of materials abated.

Clearance criteria for PCM sample analysis, in accordance with AHERA, is 0.01 fibers per cubic centimeter (0.01 f/cc) or less for each of the five samples.

Clearance criteria for TEM sample analysis, in accordance with AHERA, is an average of 70 structures per square millimeter (70 s/mm^2) or fewer for the inside-containment set of five samples.

Contractor shall return to the site to apply a lock-down encapsulant, remove poly barriers and equipment upon notification of passing clearance air samples. The barriers at window / wall openings shall be left in place.

SECTION 02200

SUPPLEMENTAL FLOOR TILE & MASTIC SPECIFICATIONS
Asbestos Abatement Specifications
Washoe County School District
Floor Tile and Mastic at District Sites

Background

Washoe County School District (WCSD) will be performing the abatement of vinyl floor tile (VFT) and mastic at various District sites. This supplemental spec as well as the District specs will apply to the removal of all Floor Tile and Mastic materials. The abatement contractor shall be prepared to abate flooring materials as identified in the site-specific architectural drawings provided for the individual site or information provided prior to bidding.

The contractor will need to note when additional asbestos-containing materials are to be abated within the same containment area and perform that work within the same negative pressure enclosure. The contractor's onsite supervisor, or project estimator during bidding, will need to confer with either WCSD or the District's independent third-party consultant, for the expected containment areas and number of containments at a particular site.

Scope of Work

The contractor awarded the project will be responsible for all costs associated with the abatement of flooring materials.

The project scope shall be determined by the site-specific architectural drawings prepared for the individual site. The Contractor is responsible for reviewing the architectural drawings and the WCSD Regulated Systems and Assessment (ES&A) Material Disturbance Permit to determine which materials, including baseboards and mastic, in the project area are asbestos-containing.

The District has retained an independent third-party abatement consultant to draft these specifications, who may provide oversight during the projects, conduct visual clearance inspections and collect clearance air samples at the conclusion of these abatement projects. All oversight or additional oversight and collection of air samples may be performed by the District's ES&A Department as well at their discretion.

In addition to complying with these supplemental specifications, the Contractor must also comply with all other asbestos abatement requirements listed in these asbestos abatement specifications. If Contractors find any conflicting information in the supplemental specifications, the Contractor must comply with the requirements listed herein that are deemed most stringent by the District or District hired asbestos consultant supervising the abatement.

Most floors in the District are concrete, but wood floors may be encountered. Since cleaning flooring mastics are difficult if not impossible on wood floors, whenever there is more than is one layer of flooring sub-floor, one layer will be removed as a part of the abatement process and properly disposed as asbestos containing materials.

Project Requirements

Contractor shall be approved by the WCSD ES&A Department to perform asbestos abatement activities within the District. **Approval of firms that have not performed activities impacting asbestos for the District previously, will need to submit all necessary documentation outlined in the WCSD ES&A Technical Specifications for the project at least ten (10) business days prior to work commencing for approval.**

All workers certifications – asbestos training and licensing and medical clearance – shall be submitted to the WCSD ES&A at least five (5) working days prior to project commencement at minimum for approval. Contractor is responsible for reviewing WCSD ES&A worker roster for the company to assure all workers to be used on the project have been approved prior to arrival onsite. Workers not identified on the approved worker list for the contractor will not be allowed to perform any activities onsite, even if documentation is provided onsite at time of the project commencement.

The abatement contractor's onsite supervisor shall have a copy of these Specifications onsite at all times and be familiar with the project requirements prior to arrival onsite at the project. Failure to follow requirements of these Specifications, or lack of knowledge of requirements to be followed during the project, are grounds for replacement of the abatement contractor's onsite supervisor.

Only the abatement contractor will be allowed to occupy the project area once abatement activities are scheduled to start. This applies to all WCSD non-ES&A staff/personnel and site staff/personnel. The area shall only be occupied by the abatement contractor, WCSD ES&A staff, and District's independent third-party abatement consultant. Other personnel will not be allowed to occupy the building during asbestos abatement activities.

Contractor shall adhere to the requirements of these Specifications, WCSD ES&A Technical Specifications, Federal, State, and Local regulations.

Water and Electricity

Water and electricity are available onsite, but long hoses and cords may be necessary. The contractor is responsible for any damage to water or power systems caused by their use of those systems.

Contractor shall provide a GFI at the primary plug-in of all electrical trains used for electrical equipment. Hose washers shall be provided at all hose connections to prevent leakage of water and potential damage to District facilities.

Pre-Cleaning

Pre-cleaning is not expected to be necessary; however, Contractor may need to remove some debris or clean surfaces to facilitate the building of negative pressure enclosure.

Notifications

Contractor is responsible for timely notifications (including courtesy notifications if applicable) to Nevada Division of Industrial Relations and Washoe County Health Department. Notifications shall be filed in advance of any waiting periods in lieu of the proposed project start date or other requirements for pre-work notification. Any revisions to notifications including project scope, start date, duration of project, or any other changes are the Contractor's responsibility. Valid notifications shall be posted onsite during the project, and copies shall be provided to the District's onsite third-party consultant.

Equipment

Contractor is responsible for providing all necessary equipment in sufficient quantities to complete the project in the schedule provided for the project. All equipment must arrive onsite clean and in proper functioning order. Any equipment that arrives onsite dirty or not in proper functioning order shall be removed from the project site for cleaning and/or repairs.

Training

Workers performing asbestos abatement activities as part of this project must have AHERA Worker training with at least one worker trained to the AHERA Contractor-Supervisor level. All workers shall be licensed by the Nevada DIR for asbestos work. The crew lead Contractor-Supervisor may not leave the site anytime asbestos abatement operations are being performed.

As noted previously, all workers certifications must be approved by the WCSD ES&A prior to arrival onsite to start work. Copies of the worker certs shall be provided to the District's onsite third-party consultant as well.

Personal Protection Equipment

The contractor is responsible for adhering to Nevada Division of Industrial Relations and OSHA requirements for worker respiratory protection. At a minimum, workers shall wear half-face, negative pressure respirators with HEPA (P-100) filters during any activities which disturb asbestos-containing materials.

Workers shall wear Tyvek-level disposable coveralls, hard hats, work gloves, and safety glasses (if not using a full face-piece respirator.) Street clothes may not be worn under disposable coveralls.

All employees shall have a valid medical clearance and fit test for respirators to be used. Medical clearance shall be provided for approval to the WCSD ES&A prior to the project commencement. Copies of the medical clearance and fit test shall be provided to the District's onsite third-party consultant as well.

Personal Air Monitoring

The contractor is responsible for the collection of personal air samples on workers during all abatement activities for asbestos. If removal activities or methods are expected to disturb any substrates which contain silica, the contractor is also responsible for collection of personal air samples for respirable crystalline silica

exposure. Asbestos and silica personal air samples shall be collected in accordance with OSHA sampling protocols and analyzed by a laboratory with the proper accreditation.

Laboratories to be used for personal air sample analysis must be approved by WCSD ES&A.

Copies of the personal air sampling results, along with laboratory accreditation, shall be submitted to the WCSD ES&A and District's independent third-party consultant.
In addition, the contractor will comply with all requirements regarding personal air monitoring listed in Section 02130, Part 2- - Air Monitoring, 2.02.

Security and Safety

The contractor is responsible for security of all equipment and safety of all employees. Contractor shall provide any storage containers or security needed for tools and equipment if needed.

Contractor is responsible for all worker safety and following all applicable regulations, namely Nevada and Federal OSHA, including for asbestos and respirable crystalline silica exposures.

Occupancy

As noted previously, the project area will be limited to the abatement contractor, WCSD ES&A staff, and District's independent third-party consultant once abatement activities are ready to commence. Once the area has been cleared, other parties may occupy.

Emergency services may also occupy areas in the event of an emergency during the project.

Challenge Testing

All HEPA-filtered equipment to be used on this project shall have been challenge tested (DOP or equivalent) within the previous 30 days prior to use onsite. Copies of the challenge testing results shall be provided to the WCSD ES&A and/or District's independent third-party consultant.

Asbestos Abatement Containment and Abatement Requirements

ALL POLY USED ON PROJECT SHALL BE 6-MIL AND FIRE-RETARDANT UNLESS EXEMPTED IN REQUIREMENTS BELOW.

Vinyl Floor Tile and Mastic Abatement

1. Contractor shall seal all critical barriers (HVAC, windows, doors, etc.) in each containment area with one layer of 6-mil poly. Doors leading outside of the containment area shall remain in place for security.

2. The contractor shall setup a regulated area and abate those areas of tiles that extend below door threshold prior to sealing of doorways as critical barriers as applicable.

3. All walls and any fixed objects that cannot be removed from the containment shall be covered with one layer of 6-mil poly. One additional layer of 4-mil poly may extend up from the floor to a height of 4' to act as a cleaning barrier.

4. A false-ceiling, minimum of 4-mil poly, shall be installed as directed by the owner or if needed to achieve and maintain sufficient negative air pressure differential as noted below. Mastic to be removed by hydro-blasting or grinding will require installation of a 4-mil poly ceiling. See hydro-blasting and grinding sections below.

5. A minimum three-stage decontamination unit with operable shower shall be contiguous with each containment. See "Decontamination Chamber Requirements" in this specification for further requirements.

6. Negative pressure shall be established and a recording manometer shall be attached to each containment. Copies of the manometer recordings shall be provided on 8.5"x11" paper by the Contractor to the District and third-party independent consultant.

7. An air pressure differential of -0.050" WC must be established and maintained throughout all phases of abatement and through receipt of passing air clearance.

8. Workers shall wet all materials prior to, and during, removal using amended water.

9. Baseboard removal shall not take place until containment is established.

10. At the conclusion of abatement, the floor surface shall be HEPA-vacuumed clean and all mastic removed. The criteria for mastic removal shall be no three-dimensional material, including mastic that may have become liquefied and entered slab divots, joints, or any other areas during the removal process.

11. All poly shall be wet-wiped or HEPA-vacuumed clean as part of detail cleaning. The 4-mil poly cleaning barrier may be removed as part of this detail cleaning unless required for maintaining sufficient air pressure differential.

12. All waste shall be placed into two separate waste bags of 6-mil thickness. The outer waste bag shall be sealed in a "gooseneck" fashion to create a leak-tight container.

For the hydro-blasting of the concrete substrate to remove mastic and for areas which must have the top surface of the concrete removed, as directed by the flooring subcontractor(s), the following requirements must be met by the Contractor:

1. For hydro-blasting, a full negative pressure containment must be constructed, including a ceiling of 4-mil poly.

2. All critical barriers must be sealed with one layer of 6-mil poly. Any fixed objects that cannot be moved out of the containment area shall be covered with one layer of 6-mil poly.

3. Contractor shall use a hydro-blasting unit to "power wash" the floors clear of mastic, including any cracks or seams in the concrete slab. This system shall have a man-operated unit that will capture the water with vacuum pressure at the front of the machine as it is operating to prevent the build-up of water in the containment.

4. The hydro-blasting unit shall be set to remove mastic on the substrate surface, cracks, and seams, without damage to the concrete slab. For areas where the top surface layer of the concrete is to be removed, at the direction of the flooring subcontractor(s), the abatement contractor shall set the hydro-blasting unit to remove the surface to a depth specified by the flooring subcontractor(s).

5. The abatement contractor shall anticipate the unit not being able to hydro-blast all areas of the containment (corners, along walls) and shall plan to use alternate methods to remove mastic or the top concrete surface in such areas. Any mechanical means to remove the mastic will need to have HEPA-filtered local exhaust.

6. At the conclusion of the hydro-blasting, the abatement contractor shall clean the floor of the containment using HEPA-vacuums followed by wet-cleaning, and HEPA-vacuuming again to assure that surfaces have been cleaned sufficiently.

7. All poly surfaces, including the ceiling, shall be wet-wiped clean as part of detail cleaning.

8. Contractor shall perform treatment of waste water prior to discharge if water will not be treated as a hazardous waste. Waste water must meet the levels of requirements provided in City of Reno Municipal Code 12.16.565.

9. Contractor shall follow all requirements, including collection of any necessary permits, for the discharge of contaminated water as required by City of Reno Municipal Code 12.16.

10. If abatement contractor will dispose of all water, they shall be responsible for profiling water for disposal. Copies of the waste profile results, along with chain of custody, shall be provided to HMS, Inc. Project Manager prior to disposal.

For the grinding of concrete floor surfaces, the work shall be performed within the same containment erected for floor tile and mastic abatement (as applicable). If areas being ground are not within a contained area (such as non-asbestos floor removal), a negative pressure enclosure shall be constructed as listed in the hydro-blasting section above. In addition to the requirements as noted above, the following engineering controls shall be met by the contractor performing the grinding of floor surfaces.

1. All power equipment to be used for the grinding of concrete floor surfaces shall have an approved shroud system that provides local exhaust.

2. A HEPA-vacuum shall be attached to the shroud system to provide the local exhaust.

3. An airless sprayer or equivalent shall be used to provide water for the suppression of any visible emissions that may be released by the work and to keep surfaces wet prior to cleaning.

4. All slurries or dust remaining within the containment area shall be HEPA-vacuumed cleaned. Additional wet-wiping to assure all dust has been cleaned in the containment area may be required.

Decontamination Requirements

A three stage decon unit including a shower is required for asbestos containments. Each chamber of the decon must have self-closing Z-flaps that seal air tight. A four-inch barrier must exist at the floor of each chamber to prevent the transfer of water and debris from chamber to chamber. This barrier will also provide a seal for the flaps between each chamber. Equipment and bag out chambers do not require a shower, but a washing station must exist and they must be three-stages. The washing station must be constructed in a manner that prevents water from splashing or traveling out of the central decon chamber. Equipment and bag out chambers must also have flaps that seal air tight.

Shower units must be equipped with an overflow pan to catch water which overfills the drain system, or is splashed out of the chamber during employee showers. Showers must be supplied with hot water, soap, shampoo, and towels for the workers. Showers shall be sited in the central decon chamber. Showers and washing station must also be equipped with a filtering system that includes a 0.5 micron filter and heated water. If a filtering system is not available or is not functioning correctly, shower water must be bagged and disposed of as asbestos-containing waste with no extra compensation being given to the Contractor.

All chambers of the decon, including the clean chamber, must be kept clean and dry (except shower) at all times. Abatement work will be stopped if decon is not kept in acceptable condition.

Regulated Area Signage

Asbestos Danger signs shall be posted at all entrances to the containment area, even if the entrance is sealed as a critical barrier. Signs shall also be posted on the flap leading into the shower station of decontamination chambers. Signage will be set once a pre-start visual is passed and work may begin in the containment, but no work will start until all signs are posted.
Signage shall meet the revised requirements set forth in 29 CFR 1926.1101(k)(7).

Air Pressure Differential

Air pressure differential must be established and maintained at -0.05 inches water differential or better before start of abatement and air pressure differential must be maintained through all phases of project, including collection of clearance air samples and receipt of results. A minimum of eight air changes per hour is required for the project. Work will be halted if the air pressure drops below -0.05 inches water differential and can resume when air pressure differential of -0.05 inches is established again.

Air pressure differential must be displayed and recorded on a properly calibrated and fully functioning

manometer. Copies of the manometer recording must be provided by the contractor on 8.5" x 11" paper at completion of project.

All negative air machines must be exhausted to the exterior of the building using wire-reinforced flex duct. All negative air machines must be used inside containment. No machines shall be attached to the exterior of the containment with the intake only inside.

Any exterior barricades need to be constructed of a minimum ½" plywood and lockable for security. Contractor is responsible for providing a lock to any exterior barricades, and keys shall be provided to WCSD site facilities coordinator and District's independent third-party consultant.

Make-Up Air Sources

Available, but may need to be HEPA-filtered. Any make-up holes in critical barriers must be equipped with a challenge/DOP-tested HEPA filter. Placing a pre-filter in the make-up air hole will not be allowed.

Disposal Requirements

All asbestos waste generated on this project will need to be double-bagged in 6-mil poly waste bags. At least one of the waste bags must be sealed in a "gooseneck" fashion. All non-friable debris shall be properly labeled and identified for disposal as an asbestos-containing waste. Materials that have become friable or which removal methods have made friable shall be labeled and identified for disposal as regulated asbestos-containing material (RACM).

The contractor will need to provide a lockable waste bin for all waste created on this project.

Waste bin will need to be labeled with asbestos signage once the waste is loaded into the bin. Waste bins shall be lined with one layer of 6-mil poly prior to waste being loaded.

Waste bins will need to arrive onsite clean of debris or any other waste and in proper functioning order. Waste bins may be rejected by WCSD ES&A staff or District's independent third-party consultant if these conditions are not met, with no extra charge to the District.

Clearance

Upon completion of asbestos abatement activities, a final visual inspection will be performed by either WCSD ES&A staff or District's independent third-party consultant. This inspection will be performed only after the abatement contractor crew supervisor has performed their own final visual clearance. Areas must be free of all three-dimensional material with all surfaces clean of dust and debris and all materials abated within the containment area. Once the containment has been successfully visually inspected and cleared, the Contractor shall apply a lock-down encapsulant to contaminated surfaces in the containment area. The contractor will need to use care to not apply encapsulant to floor surfaces which may prevent adhesion of new flooring materials.

Final clearance shall be through aggressive air sampling conducted by the District's independent third-party

consultant or a District AHERA certified technician. A set of five air samples will be collected inside the containment to be analyzed in accordance with AHERA completion of response action criteria using either phase contrast microscopy (PCM) or transmission electron microscopy (TEM), depending on the quantity of materials abated.

Clearance criteria for PCM sample analysis, in accordance with AHERA, is 0.01 fibers per cubic centimeter (0.01 f/cc) or less for each of the five samples.

Clearance criteria for TEM sample analysis, in accordance with AHERA, is an average of 70 structures per square millimeter (70 s/mm^2) or fewer for the inside-containment set of five samples.

Contractor shall return to the site to remove poly barriers and equipment upon notification of passing clearance air samples. Contractor is also responsible for washing the floor using an approved detergent cleaner and water to provide a clean surface for the new floor installation.

In the event that floor grinding is required to be completed within the same containment area, clearance air samples will be collected at the conclusion of grinding and cleaning of the surfaces within the containment area.

Supplemental Asbestos Abatement Specifications
Washoe County School District
Thermal System Insulation at District Sites

Background

Washoe County School District (WCSD) will be performing the abatement of thermal system insulation (TSI) materials at various District sites. This supplemental spec as well as the District specs will apply to the removal of all asbestos containing Thermal System Insulation. The abatement contractor shall be prepared to abate TSI materials as identified in the site-specific architectural drawings provided for the individual site or information provided prior to bidding.

The contractor will need to note when additional asbestos-containing materials are to be abated within the same containment area and perform that work within the same negative pressure enclosure. The contractor's onsite supervisor, or project estimator during bidding, will need to confer with either WCSD or the District's independent third-party consultant, for the expected containment areas and number of containments at a particular site.

Scope of Work

The contractor awarded the project will be responsible for all costs associated with the abatement of TSI materials.

The project scope shall be determined by the site-specific architectural drawings prepared for the individual site. The Contractor is responsible for reviewing the architectural drawings and the WCSD Regulated Systems and Assessment (ES&A) Material Disturbance Permit to determine which TSI materials in the project area are asbestos-containing and will be required to be abated.

The District has retained an independent third-party abatement consultant to draft these specifications, who may provide oversight during the projects, conduct visual clearance inspections and collect clearance air samples at the conclusion of these abatement projects. All oversight or additional oversight and collection of air samples may be performed by the District's ES&A Department as well at their discretion.

In addition to complying with these supplemental specifications, the Contractor must also comply with all other asbestos abatement requirements listed in these asbestos abatement specifications. If Contractors find any conflicting information in the supplemental specifications, the Contractor must comply with the requirements listed herein that are deemed most stringent by the District or District hired asbestos consultant supervising the abatement.

Project Requirements

Contractor shall be approved by the WCSD ES&A Department to perform asbestos abatement activities within the District. **Approval of firms that have not performed activities impacting asbestos for the District previously, will need to submit all necessary documentation outlined in the WCSD ES&A Technical Specifications for the project at least ten (10) business days prior to work commencing for approval.**

All workers certifications – asbestos training and licensing and medical clearance – shall be submitted to the WCSD ES&A at least five (5) working days prior to project commencement at minimum for approval. Contractor is responsible for reviewing WCSD ES&A worker roster for the company to assure all workers to be used on the project have been approved prior to arrival onsite. Workers not identified on the approved worker list for the contractor will not be allowed to perform any activities onsite, even if documentation is provided onsite at time of the project commencement.

The abatement contractor's onsite supervisor shall have a copy of these Specifications onsite at all times and be familiar with the project requirements prior to arrival onsite at the project. Failure to follow requirements of these Specifications, or lack of knowledge of requirements to be followed during the project, are grounds for replacement of the abatement contractor's onsite supervisor.

Only the abatement contractor will be allowed to occupy the project area once abatement activities are scheduled to start. This applies to all WCSD non-ES&A staff/personnel and site staff/personnel. The area shall only be occupied by the abatement contractor, WCSD ES&A staff, and District's independent third-party abatement consultant. Other personnel will not be allowed to occupy the building during asbestos abatement activities.

Contractor shall adhere to the requirements of these Specifications, WCSD ES&A Technical Specifications, Federal, State, and Local regulations.

Water and Electricity

Water and electricity are available onsite, but long hoses and cords may be necessary. The contractor is responsible for any damage to water or power systems caused by their use of those systems.

Contractor shall provide a GFI at the primary plug-in of all electrical trains used for electrical equipment. Hose washers shall be provided at all hose connections to prevent leakage of water and potential damage to District facilities.

Pre-Cleaning

Pre-cleaning of debris may be required during setup and prior to abatement of TSI.

If required, cleanup will be performed once HVAC is shut down and tagged out by the contractor, with District approval, and critical barriers are sealed with 6-mil poly. Workers performing pre-cleaning will use HEPA-vacuums to vacuum debris and dust from the area. Workers will need to wear half-mask respirator fitted with HEPA (P-100) filters and tyvek quality disposable coveralls with attached hood and boots.

Notifications

Contractor is responsible for timely notifications (including courtesy notifications if applicable) to Nevada Division of Industrial Relations and Washoe County Health Department. Notifications shall be filed in advance of any waiting periods in lieu of the proposed project start date or other requirements for pre-work notification. Any revisions to notifications including project scope, start date, duration of project, or any other changes are

the Contractor's responsibility. Valid notifications shall be posted onsite during the project, and copies shall be provided to the District's onsite third-party consultant and ES&A Department.

Equipment

Contractor is responsible for providing all necessary equipment in sufficient quantities to complete the project in the schedule provided for the project. All equipment must arrive onsite clean and in proper functioning order. Any equipment that arrives onsite dirty or not in proper functioning order shall be removed from the project site for cleaning and/or repairs.

Training

Workers performing asbestos abatement activities as part of this project must have AHERA Worker training with at least one worker trained to the AHERA Contractor-Supervisor level. All workers shall be licensed by the Nevada DIR for asbestos work. The crew lead Contractor-Supervisor may not leave the site anytime asbestos abatement operations are being performed.

As noted previously, all workers certifications must be approved by the WCSD ES&A prior to arrival onsite to start work. Copies of the worker certs shall be provided to the District's onsite third-party consultant as well.

Personal Protection Equipment

A tight-fitting powered air-purifying respirator (PAPR) fitted with HEPA filters shall be worn for respiratory protection when performing TSI abatement.

A full facepiece, supplied-air respirator operated in the pressure-demand mode shall be worn by workers performing Class 1 work if the negative exposure assessment, or air sampling performed by ES&A or the District's third-party consultant, indicates that the exposure level will be above 1 f/cc as an 8-hour TWA.

Workers shall wear Tyvek-level disposable coveralls, hard hats, and work gloves. Street clothes may not be worn under disposable coveralls.

All employees shall have a valid medical clearance and fit test for respirators to be used. Medical clearance shall be provided for approval to the WCSD ES&A prior to the project commencement. Copies of the medical clearance and fit test shall be provided to the District's onsite third-party consultant as well.

Personal Air Monitoring

The contractor is responsible for the collection of personal air samples on workers during all abatement activities for asbestos. These samples shall be collected in accordance with OSHA sampling protocols and analyzed by a laboratory with the proper accreditation.

Laboratories to be used for personal air sample analysis must be approved by WCSD ES&A.

Copies of the personal air sampling results, along with laboratory accreditation, shall be submitted to the WCSD ES&A and District's independent third-party consultant.

In addition, the contractor will comply with all requirements regarding personal air monitoring listed in Section 02130, Part 2- - Air Monitoring, 2.02.

Security and Safety

The contractor is responsible for security of all equipment and safety of all employees. Contractor shall provide any storage containers or security needed for tools and equipment if needed.

Contractor is responsible for any ladder, scaffolding, or any other worker safety measures needed to facilitate the TSI abatement as required by state or Federal regulation.

Contractor is responsible for all worker safety and following all applicable regulations, namely Nevada and Federal OSHA.

Occupancy

As noted previously, the project area will be limited to the abatement contractor, WCSD ES&A staff, and District's independent third-party consultant once abatement activities are ready to commence. Once the area has been cleared, other parties may occupy.
Emergency services may also occupy areas in the event of an emergency during the project.

Challenge Testing

All HEPA-filtered equipment to be used on this project shall have been challenge tested (DOP or equivalent) within the previous 30 days prior to use onsite. Copies of the challenge testing results shall be provided to the WCSD ES&A and/or HMS, Inc.

Asbestos Abatement Containment and Abatement Requirements

ALL POLY USED ON PROJECT SHALL BE 6-MIL AND FIRE-RETARDANT UNLESS EXEMPTED IN REQUIREMENTS BELOW.

1. The Contractor shall develop a regulated area that meets the requirements of OSHA regarding posting and limited access.

2. The Contractor shall follow the procedures recommended by the manufacturer of the glovebags, and the specifications required by OSHA regulations.

3. All critical openings within the regulated area shall be sealed prior to set up of the containment using two layers of 6 mil poly.

4. At least one layer of 6 mil poly must be used to contain the abatement area, including ceiling. Two layers of 6 mil poly shall be placed on the floor of the containment. The bottom layer of floor poly must be black to assist with visual clearance.

5. Stationary objects in the immediate area of the room which cannot be removed from the work area must be covered with at least one layer of 6 mil poly sheeting after being pre-cleaned.

6. A minimum three stage decontamination unit with a shower shall be contiguous with the containment. See “Decontamination Chamber Requirements” in this specification for further requirements.

7. Negative pressure shall be established and a recording manometer shall be attached to the containment. Copies of the manometer recordings shall be provided on 8.5”x11" paper by the Contractor.

8. A HEPA-filtered vacuum shall be in the immediate area for use in conjunction with the bags or in case of a spill.

9. Glovebags may not be used on surfaces where temperatures exceed 150 degrees Fahrenheit.

10. Glovebags will be utilized only used inside of a full negative pressure containment.

11. Glovebags may be used only once, and may not be moved or slid for removal of a second section of TSI.

12. At least two persons shall perform glovebag removal.

13. Before beginning the operation, loose and friable material adjacent to the glovebag operation shall be wrapped and sealed in two layers of 6 mil poly sheeting or otherwise rendered intact using encapsulating cloth.

14. The Contractor shall apply a sufficient volume of amended water to wet all pipewrap removed from the pipes while it is enclosed in the glovebag.

15. Prior to placement in the disposal bag, glovebags shall be collapsed by removing air within them using a HEPA-vacuum.

16. Upon detachment, the glovebag must be immediately placed into a 6 mil thick disposal bag. The disposal bags must be sealed using the "gooseneck" sealing technique. Waste bags shall be properly labeled as a regulated asbestos containing waste.

17. Where pipes enter walls, floors, or ceilings which are not within the scope of the project, the pipewrap shall be removed at least 1" into the structure and the pipewrap end must be sealed with bridging encapsulant and/or wettable cloth.

18. The Contractor shall be responsible for ensuring the piping system remains adequately supported at all times. This may be achieved by readjusting existing hanger brackets as insulation is removed, or by other approved methods, such as inserting wood blocks to replace the thickness of the removed insulation.

Decontamination Requirements

A three stage decon unit including a shower is required for asbestos containments. Each chamber of the decon must have self-closing Z-flaps that seal air tight. A four-inch barrier must exist at the floor of each chamber to prevent the transfer of water and debris from chamber to chamber. This barrier will also provide a seal for the flaps between each chamber. Equipment and bag out chambers do not require a shower, but a washing station must exist and they must be three-stages. The washing station must be constructed in a manner that prevents water from splashing or traveling out of the central decon chamber. Equipment and bag out chambers must also have flaps that seal air tight.

Shower units must be equipped with an overflow pan to catch water which overfills the drain system, or is splashed out of the chamber during employee showers. Showers must be supplied with hot water, soap, shampoo, and towels for the workers. Showers shall be sited in the central decon chamber. Showers and washing station must also be equipped with a filtering system that includes a 0.5 micron filter. If filtering system is not available or is not functioning correctly, shower water must be bagged and disposed of as asbestos-containing waste.

All chambers of the decon, including the clean chamber, must be kept clean and dry (except shower) at all times. Abatement work will be stopped if decon is not kept in acceptable condition.

Regulated Area Signage

Asbestos Danger signs shall be posted at all entrances to the containment area, even if the entrance is sealed as a critical barrier. Signs shall also be posted on the flap leading into the shower station of decontamination chambers. Signage will be set once a pre-start visual is passed and work may begin in the containment, but no work will start until all signs are posted.

Signage shall meet the revised requirements set forth in 29 CFR 1926.1101(k)(7).

Air Pressure Differential

Air pressure differential must be established and maintained at -0.05 inches water differential or better before start of abatement and air pressure differential must be maintained through all phases of project, including collection of clearance air samples and receipt of results. A minimum of eight air changes per hour is required for the project. Work will be halted if the air pressure drops below -0.05 inches water differential and can resume when air pressure differential of -0.05 inches is established again.

Air pressure differential must be displayed and recorded on a properly calibrated and fully functioning manometer. Copies of the manometer recording must be provided by the contractor on 8.5" x 11" paper at completion of project.

All negative air machines must be exhausted to the exterior of the building using wire-reinforced flex duct. All negative air machines must be used inside containment. No machines shall be attached to the exterior of the containment with the intake only inside.

Any exterior barricades need to be constructed of a minimum ½" plywood and lockable for security. Contractor is responsible for providing a lock to any exterior barricades, and keys shall be provided to WCSD site facilities coordinator and HMS, Inc. Project Manager.

Make-Up Air Sources

Available, but may need to be HEPA-filtered. Any make-up holes in critical barriers must be equipped with a challenge/DOP-tested HEPA filter. Placing a pre-filter in the make-up air hole will not be allowed.

Disposal Requirements

All asbestos waste generated on this project will need to be double-bagged in 6-mil poly waste bags, or double-wrapped in 6-mil polyethylene sheeting. All waste bags must be sealed in a "gooseneck" fashion. All waste shall be properly labeled and identified for disposal as a regulated asbestos-containing material (RACM).

The contractor will need to provide a lockable waste bin for all waste created on this project.Waste bin will need to be labeled with asbestos signage once the waste is loaded into the bin. Waste bins shall be lined with one layer of 6-mil poly prior to waste being loaded.

Waste bins will need to arrive onsite clean of debris or any other waste and in proper functioning order. Waste bins may be rejected by WCSD ES&A staff or District's independent third-party consultant if these conditions are not met, with no extra charge to the District.

Clearance

Upon completion of asbestos abatement activities, a final visual inspection will be performed by either WCSD ES&A staff or District's independent third-party consultant. This inspection will be performed only after the abatement contractor crew supervisor has performed their own final visual clearance. Areas must be free of all three-dimensional material with all surfaces clean of dust and debris and all materials abated within the containment area.

Final clearance shall be through aggressive air sampling conducted by the District's independent third-party consultant. A set of five air samples will be collected inside the containment to be analyzed in accordance with AHERA completion of response action criteria using either phase contrast microscopy (PCM) or transmission electron microscopy (TEM), depending on the quantity of TSI abated.

Clearance criteria for PCM sample analysis, in accordance with AHERA, is 0.01 fibers per cubic centimeter (0.01 f/cc) or less for each of the five samples. Clearance criteria for TEM sample analysis, in accordance with AHERA, is an average of 70 structures per square millimeter (70 s/mm^2) or fewer for the inside-containment set of five samples.

Contractor shall return to the site to apply a lock-down encapsulant, remove poly barriers and equipment upon notification of passing clearance air samples.