Washoe County School District

Project Title:
Construction of New Stead Area Elementary School

Bid #:
25-13-B-08-DA

Date:
August 23, 2024

Prepared By:
Purchasing Department
14101 Old Virginia Road, Room 0
Reno, NV 89521
Phone: (775) 850-8025
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SECTION 00090 - NOTICE TO CONTRACTORS

Sealed bids for the **Construction of New Stead Area 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 October 3, 2024**. The bids will be opened publicly via a TEAMS Meeting at **2:30 pm (local time).**

https://teams.microsoft.com/l/meetup-join/19%3ameeting_NTdjNjFmYTktOTM4ZS00ODgzLWEyYjMtNzc1ZDllZDUxNjQz%40thread.v2/0?context=%7b%22Tid%22%3a%223cacf549-5e36-41cc-a3de-89459e121def%22%2c%22Oid%22%3a%224cf09aab-f212-4f29-a98f-538ed07bf681%22%7d

Meeting ID: 228 692 504 424
Passcode: CHcfom

Scope of Work: Construction of a new 88,000 square foot, Type II-B, two (2) story elementary school at 926 Cloudburst Drive, Reno, NV 89506. This project includes, but is not limited to; site work, grading, paving, landscaping and irrigation, underground utilities, ground source heat pump wellfield, masonry, structural steel, plumbing, HVAC & electrical, membrane roofing, architectural metal stud walls, insulation, aluminum framed windows, doors, frames and door hardware, casework, insulation, painting and flooring as drawn and specified.

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 Facilitating Buyer 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 11:00 a.m. on September 5, 2024 at the Brown Center (Meet In Front Of The Office) 14101 Old Virginia Road, Reno, NV 89521.

An **OPTIONAL** site walk will be available to any interested parties at **7:30 a.m. on September 6, 2024 at JWood Raw Elementary School (Meet In Front Of The Office) 10600 Green Pasture Drive, Reno, NV 89521.** Due to access and coordination involved in this project we highly recommend that contractors walk the project site that we are making available. All interested parties shall meet in front of the Office. A Capital Projects representative will make the site available to walk/investigate the affected areas.

The physical work is to be commenced upon issuance of a "Notice to Proceed". Substantial Completion shall be completed on or before May 1, 2026 and Final Completion shall be completed on or before July 1, 2026.

Bid #: 25-13-B-08-DA
PWP #: WA-2025-012

Facilitating Buyer: Dawn Allshouse
Email: solicitations@washoeschools.net

To be published in the Reno Gazette Journal on August 23, 2024.

Washoe County School District
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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 October 3, 2024**. 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". Substantial Completion shall be completed on or before May 1, 2026 and Final Completion shall be completed on or before July 1, 2026.

Contractor must agree that Owner may retain from the monies due the Contractor Five Thousand Dollars ($5,000) 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 *September 12, 2024*** and an addendum will be issued with responses.

- All FINAL questions shall be submitted by **4:30 p.m. (Local Time) on *September 20, 2024*** and a FINAL addendum will be issued with responses.

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.

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 *September 12, 2024*** and an addendum will be issued with responses.

- All FINAL questions shall be submitted by **4:30 p.m. (Local Time) on *September 20, 2024*** 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
From 7:00 a.m. until 7:00 p.m. Monday through Friday and from 9:00 a.m. until 5:00 p.m. on Saturday the project site will be available to the Contractor.

Schedule
Substantial Completion shall be completed by May 1, 2026 and Final Completion shall be completed by July 1, 2026.

Special Note
The Owner shall move in all materials, furniture, fixtures and equipment upon Substantial Completion through July 1, 2026.

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.

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.

Tribal Monitor

WCSD will provide the services of a Tribal Monitor for the entire duration of all grading activities. Contractor will be required to coordinate schedule with Tribal Monitor. Should any cairn or grave of a Native American be discovered during site development, work shall temporarily be halted at the specific site and the Sheriff's Office as well as the State Historic Preservation Office of the Department of Conservation and Natural Resources shall be immediately notified per NRS 383.170.

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.

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.

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: **$10,000,000** minimum or the amount customarily carried by the Contractor, whichever is greater, combined single limit per occurrence (with $10,000,000 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: N/A

G. ASBESTOS COVERAGE

Not Required For This Project.

H. PROPERTY COVERAGES

The Contractor shall provide Builders Risk Insurance on the entire work, including but not limited to, temporary equipment, tools, temporary structures, temporary buildings, scaffolding, or other contractor property, etc. Flood coverage will also be included for projects that are within the 500-year flood plain. Such insurance shall be written on a completed value form and in an amount equal to the initial contract sum plus 10%, subject to subsequent modifications of the contract sum. The insurance shall apply on a replacement cost basis. Coverage shall, at a minimum, cover the causes of loss insured under the ISO special causes of loss form (CP 10 30) including earthquake coverage for the full replacement cost of the project, expediting and extra expense coverage with limits of at least $10,000,000 or 20% of the project, whichever is less, on a policy form satisfactory to the Owner, and shall be endorsed as needed to provide full coverage for loss or damage from collapse, including collapse resulting from design error. Coverage shall also include reasonable compensation for architects' services and expenses made necessary by an insured loss. Insured property shall include portions of the work located away from the site but intended for use at the site and shall also cover portions of the work in transit. The policy shall cover the cost of removing debris, including demolition as may be made legally necessary by the operation of any law, ordinance, or regulation.

The Contractor shall also provide Boiler and Machinery Insurance coverage with replacement cost endorsement with a minimum limit of 25% (twenty-five percent) of the bid value unless released from this responsibility, in writing, by the Owner prior to the execution of the Contract. Coverage shall be included for insured objects during installation, start-up, testing and until final acceptance by the Owner.

All policies shall include the Owner, Contractor, Subcontractors and suppliers as named insureds. Losses paid under any policy or policies shall be paid jointly to the owner, contractor and any other qualifying insureds. The Contractor shall comply with all warranties required by the insurer. Any deductible or self-insured retention shall be the responsibility of the Contractor.

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 **$1,000** 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, and all other expenses 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	Allowable Fee
+$0.01 to +$50,000	15% of the Total Cost
+$50,000.00 and above	10% of the Total Cost
2. Additive Changes (Contractor Markup) Subcontractors work:	
Total Cost of Change	Allowable Fee
+$0.01 to +$50,000	10% of the Total Subcontractor Fee
+$50,000.00 and above	5% of the Total Subcontractor Fee
3. Deductive Changes:	
Total Credit Cost of Change	Credit Fee to be Applied
+$0.01 to +$50,000	10% of the Total Subcontractor Cost. (*Deductive*)
+$50,000.00 and above	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 show precisely 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 Building Information Modeling (BIM) showing the exact alignment, physical location and configuration of systems installations.

The Level of Development (LOD) for BIM shall be LOD 300. At the completion of the project, said model shall be provided to the owner in full editable and usable format. The Model or Revit file will be provided to the awarded contractor.

BIM modeling shall, at a minimum, include:

a. All duct work and air handling equipment. Ductwork shall show flanges. Model shall show insulation around duct work.
b. All mechanical equipment.
c. All hangers including unistrut, clevis, all-thread and strap material.
d. Duct fittings including HETO and flex and diffusers/grilles.
e. Electrical work and controls conduit cumulating 1.5" or larger.
f. Mechanical access zones.
g. Fire/Smoke or fire dampers including access zones.
h. Mechanical piping larger than ¾".
i. Refrigerant lines, no matter the size.
j. Cable tray.
k. Electrical Equipment.
l. All hangers and supports for electrical equipment.
m. All light fixtures.
n. All power feeds including conduit or bus bars.
o. Outlets and switches where location is a priority for architectural.
p. Electrical equipment access zones.
q. All occupancy sensors, daylight sensors, exit signs, fire alarm strobes and horns, cameras, speakers, and AV equipment located in ceiling grid.
r. Natural gas lines larger than ½".
s. Plumbing lines larger than ½".

t. Insulation shall be shown with the correct sizing on plumbing lines.
u. All plumbing valves and cleanouts.
v. Access zones to plumbing valves and cleanouts.
w. Fire protection piping no matter the size.
x. Fire protection drops.
y. Fire protection equipment.
z. The entire steel structure including beams, columns, supports, braces, bent plate, supports or secondary supports.
aa. All catwalks and their support systems.
bb. All concrete and block structures include walls, columns or beams.
cc. All access doors in the architectural ceiling for access to all electrical, plumbing and mechanical systems.
dd. Ceiling grid.
ee. All walls windows and doors.
ff. Lab hoods.
gg. Soda Machine Lines.
hh. Kitchen equipment and hoods.

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 15.1.8.

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 Substantial Completion shall be completed on or before May 1, 2026 and final Completion shall be completed on or before July 1, 2026.

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

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.
From 7:00 a.m. until 7:00 p.m. Monday through Friday and from 9:00 a.m. until 5:00 p.m. on Saturday the project 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.

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

e. Final payment shall not be made until the original closed out permit for the work has 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.

BID FORM

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

Bid #: 25-13-B-08-DA
PWP # WA-2025-012

Having carefully examined all of the Bid Specifications entitled **Construction of New Stead Area Elementary School,** dated August 23, 2024; and the Drawings dated August 12, 2024; 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	$2,225,000.00
C.	**TOTAL – BASE BID 1 AND FORCE ACCOUNT (The Sum of Box A + Box B)**: All labor and materials for the **CONSTRUCTION OF NEW STEAD AREA ELEMENTARY SCHOOL** as drawn and specified, the sum of _____ _____Dollars ($_____).	

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 quote 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. Substantial Completion shall be completed on or before May 1, 2026 and Final Completion shall be completed on or before July 1, 2026. 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 Five Thousand Dollars ($5,000) 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 #: 25-13-B-08-DA

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: **CONSTRUCTION OF NEW STEAD AREA ELEMENTARY SCHOOL**

BID #: **25-13-B-08-DA**

DESCRIPTION OF WORK	SUBCONTRACTOR	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: **CONSTRUCTION OF NEW STEAD AREA ELEMENTARY SCHOOL**

BID #: **25-13-B-08-DA**

DESCRIPTION OF WORK	SUBCONTRACTOR	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**

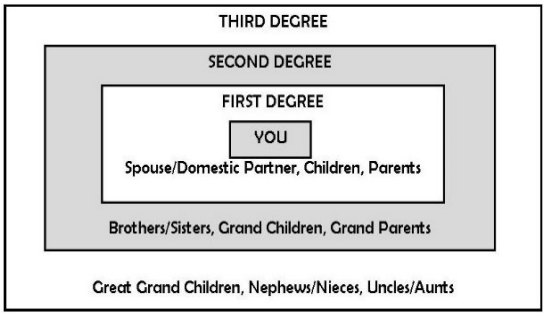
If you DISAGREE and cannot certify, then please explain:

_____
_____
_____

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 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

G001 TITLE SHEET – VOLUME 1
G101 PROJECT DATA AND SHEET INDEX – VOLUME 1
G102 CODE ANALYSIS – FIRST FLOOR
G103 CODE ANALYSIS – SECOND FLOOR
G105 BUILDING ENVELOPE COMPLIANCE
G210 FIRE PROTECTION ASSEMBLIES
G211 FIRE PROTECTION ASSEMBLIES
G212 FIRE PROTECTION ASSEMBLIES
G301 ACCESSIBILITY DIAGRAMS
G401 WALL TYPES
G401A WALL TYPES AND DETAILS
G402 TYPICAL METAL STUD FRAMING DETAILS
G403 ACOUSTICAL PENETRATION DETAILS
G500 SIGNAGE SCHEDULE
G501 SIGNAGE DETAILS
G511 SIGNAGE FIRST FLOOR PLAN – AREAS A + B
G512 SIGNAGE FIRST FLOOR PLAN – AREA C
G513 SIGNAGE SECOND FLOOR PLAN – AREA C

C001 CIVIL GENERAL INFORMATION
C002 CIVIL GENERAL INFORMATION CONTINUED
C101 CIVIL SITE PLAN NORTH
C102 CIVIL SITE PLAN SOUTH
C201 CIVIL GRADING PLAN NORTH
C202 CIVIL GRADING PLAN SOUTH
C203 CIVIL EROSION CONTROL PLAN
C211 CIVIL RETAINING WALL #1 PLAN AND PROFILE
C212 CIVIL RETAINING WALL #2 PLAN AND PROFILE
C213 CIVIL RETAINING WALL #3 PLAN AND PROFILE
C214 CIVIL RETAINING WALL #4 PLAN AND PROFILE
C301 CIVIL STORM AND SEWER PLAN
C302 CIVIL STORM AND SEWER PLAN
C303 CIVIL PRIVATE WATER PLAN
C304 CIVIL PRIVATE WATER PLAN
C601 CIVIL ON-SITE SIGNAGE, STRIPING AND FENCING PLAN
C602 CIVIL ON-SITE SIGNAGE, STRIPING AND FENCING PLAN
C603 CIVIL OFF-SITE SIGNAGE AND STRIPING PLAN
C611 SAFE ROUTES DISPLAY
C1001 CIVIL DETAIL SHEET
C1002 CIVIL DETAIL SHEET
C1003 CIVIL DETAIL SHEET
C1004 CIVIL DETAIL SHEET
C1005 CIVIL DETAIL SHEET
C1006 CIVIL DETAIL SHEET
C1007 CIVIL DETAIL SHEET
C1008 CIVIL DETAIL SHEET

SECTION 01015 – SCHEDULE OF DRAWINGS

C1009	CIVIL DETAIL SHEET
C1010	CIVIL DETAIL SHEET
L100	LANDSCAPE PLAN
L101	LANDSCAPE NOTES
L102	LANDSCAPE DETAILS
L200	IRRIGATON PLAN
L201	IRRIGATION DETAILS AND NOTES
L300	LANDSCAPE AND IRRIGATION DETAILS
A001	OVERALL SITE PLAN
A002	ENLARGED SITE PLANS
A003	ENLARGED SITE PLANS AND DETAILS
A004	SITE DETAILS
A005	CONCRETE JOINT PLANS AND METAL SHADE STRUCTURE DETAILS
A006	SITE STAIR AND RAMP PLANS AND DETAILS
A110	OVERALL FIRST FLOOR PLAN
A111	ENLARGED FIRST FLOOR PLANS – AREAS A + B
A112	DIMENSION FIRST FLOOR PLANS – AREAS A + B
A113	ENLARGED FIRST FLOOR PLAN – AREA C
A114	DIMENSION FIRST FLOOR PLANS – AREA C
A120	OVERALL SECOND FLOOR PLAN
A121	ENLARGED SECOND FLOOR PLANS – AREAS A + B
A122	DIMENSION SECOND FLOOR PLANS – AREAS A + B
A123	ENLARGED SECOND FLOOR PLAN – AREA C
A124	DIMENSION SECOND FLOOR PLAN – AREA C
A125	SOUTHEAST CLASSROOM PLANS
A131	ENLARGED PLANS – KITCHEN, PTA KITCHEN, CLASSROOMS AND ADMIN ASST.
A132	ENLARGED RESTROOM PLANS AND ELEVATIONS
A133	ENLARGED RESTROOM PLANS AND ELEVATIONS
A200	OVERALL ROOF PLAN
A201	ENLARGED ROOF PLANS – AREAS A + B
A202	ENLARGED ROOF PLANS – AREA C
A210	ROOF DETAILS
A211	ROOF DETAILS
A212	ROOF DETAILS
G002	TITLE SHEET – VOLUME 2
G003	PROJECT DATA AND SHEET INDEX – VOLUME 2
M001	MECHANICAL – LEGENDS, NOTES AND SCHEDULES
M002	MECHANICAL – SCHEDULES
M003	MECHANICAL – SCHEDULES
M004	MECHANICAL – SCHEDULES
M010	MECHANICAL – SITE PLAN

M110	MECHANICAL – OVERALL FIRST FLOOR PLAN
M111	MECHANICAL – FIRST FLOOR ZONING PLAN
M120	MECHANICAL – OVERALL SECOND FLOOR PLAN
M121	MECHANICAL – SECOND FLOOR ZONING PLAN
M131	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA A1
M132	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA B1
M133	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA B2
M134	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA B3
M135	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA B4
M136	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA C1’
M137	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA C2
M138	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA C3
M139	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA C4
M140	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA C5
M141	MECHANICAL – PARTIAL FIRST FLOOR PLAN – AREA C6
M142	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA A1
M143	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA B1
M144	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA B2
M145	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA B4
M146	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA C1
M147	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA C2
M148	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA C3
M149	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA C4
M150	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA C5
M151	MECHANICAL – PARTIAL SECOND FLOOR PLAN – AREA C6
M152	MECHANICAL – PARTIAL SOUTHEAST CLASSROOM PLANS – AREA C
M160	MECHANICAL - OVERALL ROOF PLAN
M601	MECHANICAL – DETAILS
M602	MECHANICAL – DETAILS
M603	MECHANICAL – DETAILS
M604	MECHANICAL – DETAILS
M605	MECHANICAL – DETAILS
M606	MECHANICAL – DETAILS
TC001	MECHANICAL – TEMPERATURE CONTROLS
TC002	MECHANICAL – TEMPERATURE CONTROLS
TC003	MECHANICAL – TEMPERATURE CONTROLS

P001	PLUMBING – LEGEND, NOTES AND SCHEDULES
P010	PLUMBING – SITE PLAN
P110	PLUMBING – OVERALL FIRST FLOOR PLAN
P120	PLUMBING – OVERALL SECOND FLOOR PLAN
P131	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA A1
P132	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA B1
P133	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA B2
P134	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA B3
P135	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA B4

P136	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA C1
P137	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA C2
P138	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA C3
P139	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA C4
P140	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA C5
P141	PLUMBING – PARTIAL FIRST FLOOR PLAN – AREA C6
P142	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA A1
P143	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA B1
P144	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA B2
P145	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA B3
P146	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA B4
P147	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA C1
P148	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA C2
P149	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA C3
P150	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA C4
P151	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA C5
P152	PLUMBING – PARTIAL SECOND FLOOR PLAN – AREA C6
P153	PLUMBING – PARTIAL SOUTHWEST CLASSROOM PLANS – AREA C
P160	PLUMBING – OVERALL ROOF PLAN
P501	PLUMBING – DETAILS
P502	PLUMBING – DETAILS

FP001	FIRE PROTECTOON – LEGEND, SCHEDULES AND NOTES
FP110	FIRE PROTECTION – OVERALL FIRST FLOOR PLAN
FP120	FIRE PROTECTION – OVERALL SECOND FLOOR PLAN

SECTION 01020 – PERSONNEL SAFETY CHECK APPLICATION (NEW CONSTRUCTION)

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 (NEW CONSTRUCTION)

Washoe County School District – Capital Improvement Projects' New Facilities

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.

1. 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

2. 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.

3. 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.

4. The total shall equal the Contract Sum.

5. 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.

6. 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.

7. 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

B. 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 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: _____
_____
_____
_____
_____

CLARIFICATION: _____
_____
_____
_____
_____

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

SECTION 01041 – PROJECT MANAGEMENT SOFTWARE

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 punchlist 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.

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 01050 - FIELD ENGINEERING

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. General: This section specifies administrative and procedural requirements for field engineering services including, but not limited to, the following:

1. Land survey work

2. Civil Engineering Services

3. Damage Surveys

4. Geotechnical Monitoring

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

1. Division 1 SECTION 01040 – COORDINATION for procedures for coordinating field engineering with other construction activities.

2. Division 1 SECTION 01300 – SUBMITTALS for submitting project record surveys.

3. Division 1 SECTION 01700 – CONTRACT CLOSEOUT for submitting final property survey with Project Record Documents and recording of Owner accepted deviations from indicated lines and levels.

1.3 SUBMITTALS

A. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements upon completion of construction.

B. Final Property Survey: Submit ten (10) copies of the final property survey.

C. Project Record Documents: Submit a record of work performed and record survey data as required under provisions of SECTION 01300 – SUBMITTALS and SECTION 01700 – CONTRACT CLOSEOUT.

1.4 QUALITY ASSURANCE

A. Surveyor Qualifications: Engage a land surveyor registered in the State of Nevada, to perform required land surveying services.

B. Engineer Qualifications: Engage an engineer of the discipline required, licensed in the State of Nevada, to perform required engineering services.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 EXAMINATION

A. Identification: The Owner will identify existing control points and property line corner stakes.

B. Verify layout information shown on the drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.

2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.

C. Establish and maintain a minimum of two (2) permanent benchmarks on the site, referenced to data established by survey control points.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction.

1. Prior to construction, verify the location and invert elevation at points of connection of all underground utility including but not limited to sanitary sewer, storm sewer, water service piping, electric conduits and gas service piping.

3.2 PERFORMANCE

A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each stage/story of construction and elsewhere as needed to locate each element of the project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale drawings to determine dimensions.

   1. Advise entities engaged in construction activities of marked lines and levels provided for their use.

   2. As construction proceeds, check every major element for line, level and plumb.

B. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference.

   1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.

   2. On completion of foundation walls, major site improvements and other work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles and elevations of construction and site work.

C. Site Improvements: Locate and lay out site improvements, including but not limited to, pavements; stakes for grading; fill and topsoil placement; utility; slopes; invert elevations; etc.

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical work.

E. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in or affected by construction. Coordinate with local Authorities Having Jurisdiction (AHJ).

F. Final Property Survey: Prepare a final property survey showing significant features (real property) for the project. Include on the survey a certification, signed by the Surveyor, that principal metes, bounds, lines and levels of the project are accurately positioned as shown on the survey.

   1. Recording: At Substantial Completion, have the final property survey recorded by or with the AHJ as the official Property Survey.

END OF SECTION 01050

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.

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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									
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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

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.

Washoe County School District

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 HARRIS
LABOR COMMISSIONER

OFFICE OF THE LABOR COMMISSIONER
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CARSON CITY, NV 89706
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2024 PREVAILING WAGE RATES
WASHOE COUNTY REGION

DATE OF DETERMINATION: October 1, 2023

APPLICABLE FOR PUBLIC WORKS PROJECTS OVER $100,000 BID/AWARDED OCTOBER 1, 2023 THROUGH SEPTEMBER 30, 2024

Pursuant to Nevada Revised Statutes (NRS) section 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 section 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)

PREVAILING WAGE DETERMINATIONS - NRS 338.030 subsection 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.

Senate Bill 243 passed during the 80th Nevada Legislative Session (2019) and set forth in NRS section 338.025, now requires the Labor Commissioner to calculate the Prevailing Wage Rates by region. NRS section 338.025 Prevailing wage regions. For the purpose of determining the prevailing rate of wages pursuant to NRS section 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 section 338.030 subsection 2. Objections to the Prevailing Wage Determinations must be submitted within 30 days after the Prevailing Wage Determinations are issued.

Pursuant to NRS section 338.030 subsection 8, the Labor Commissioner will review the prevailing wage rates in each even-numbered year to determine if adjustments should be made.

As Amendments/Revisions are made to the wage rates, they will be posted on the website for each respective Region. Please review regularly for any Amendments/Revisions that are posted or contact our offices directly for further assistance.

Air Balance Technician 4
Alarm Installer 5
Boilermaker 6
Bricklayer 7
Carpenter 8
Cement Mason 9
Electrician – Communication Technician 10
Electrician - Lineman 11
Electrician – Neon Sign 13
Electrician - Wireman 14
Elevator Constructor 15
Fence Erector 17
Flagperson 18
Floorcoverer 19
Glazier 20
Highway Striper 22
Hod Carrier-Brick Mason 23
Hod Carrier – Plasterer Tender 24
Ironworker 26
Laborer 29
Lubrication And Service Engineer (Mobile And Grease Rack) 30
Mechanical Insulator 31
Millwright 32
Operating Engineer 35
Operating Engineer – Steel Fabricator & Erector 35
Operating Engineer – Piledriver 36
Painter 38
Piledriver (Non-Equipment) 40
Plasterer 42
Plumber/Pipefitter 43
Refrigeration 44
Roofer 45
Sheet Metal Worker 46
Soils and Material Tester 47
Sprinkler Fitter 47
Surveyor 48
Taper 49
Tile/Terrazzo Worker/Marble Mason Finisher 50
Tile/Terrazzo Worker/Marble Mason 51
Traffic Barrier Erector 53
Truck Driver 54
Well Driller 56

Group Classifications

Labor Group Classifications 57
Operating Engineers 61

NRS section 338.010 subsection (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.

NRS section 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 section 338.030.

Please see NRS sections 338.010, 338.020, and 338.035 and Nevada Administrative Code (NAC) sections 338.0097 and 338.092 through 338.100 for further details on "Bona fide fringe benefits" and 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 section 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……73.87
Air Balance Technician-Foreman…….....78.26
Air Balance Technician-General Foreman……82.65

ADD ZONE RATE
In addition to AIR BALANCE 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 the employee shall be provided reasonable lodging and meal expenses.

ADD PREMIUM PAY
All hourly rates are subject to Over Time (One and one half 1 ½) of the Regular rate:
1. For all hours worked over Eight (8) Hours in one day or shift.
2. For the first Eight (8) Hours work on Saturday.

All hourly rates are subject to Double Time of the Regular Rate:
1. For all hours worked over Ten (10) Hours in one day or shift.
2. For all hours worked over Eight (8) Hours on Saturday.
3. For all hours worked on Sunday, New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Nevada Day, Thanksgiving Day, Day after Thanksgiving, Day before Christmas, and Christmas Day.

RECOGNIZED HOLIDAYS
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Nevada Day, Thanksgiving Day, Day after Thanksgiving, Day before Christmas, and Christmas Day

JOB DESCRIPTION: Excerpt from Sheet Metal Local 26 Collective Bargaining Agreement

(a) 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; (b) all lagging over insulation and all duct lining; (c) testing and balancing of all air-handling equipment and duct work; (d) 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; (e) metal roofing; and (f) all other work included in the jurisdictional claims of International Association of Sheet Metal, Air, Rail and Transportation Workers.

Craft: ALARM INSTALLER (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Alarm Installer……..……39.90

JOB DESCRIPTION:
Includes but is not limited to:

1. Installing or testing electrical protective signaling systems used to provide notification of fire, burglary or other irregularities on the premises of the subscriber of the system;
2. Installing of wiring and signaling units;
3. Repairing electrical protective signaling systems
4. Starting up, programming and documenting systems;

Craft: BOILERMAKER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Boilermaker……72.01
Boilermaker Foreman……74.51

ADD 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.

PER DIEM payments and TRAVEL pay shall be paid as follows:
The Contractor shall pay the employee Per Diem in the amount of seventy-five dollars ($75 .00) per day worked where the job site is 70 miles or more but Jess than 120 miles from the dispatch point.
For mileage of 120 miles or more, the daily Per Diem amount shall be ninety dollars ($90.00) per day worked.
Where the job site is over 120 miles or more from the dispatch point, employees shall receive the I.R.S. maximum allowable per mile for transportation between the dispatch point and the job site at the beginning and conclusion of their employment.
Where a job is located two hundred and forty (240) miles or more from the dispatch point, the employee will receive one additional day's Per Diem at the beginning of employment and one additional day's Per Diem at the conclusion of employment.

JOB DESCRIPTION:

Includes but is not limited to:

1. Constructing, assembling, maintaining and repairing stationary steam boilers and boiler house auxiliaries;
2. Aligning structures or plate sections to assemble boiler frame tanks or vats;
3. Assisting in the testing of assembled vessels, directing cleaning of boilers and boiler furnaces;
4. Inspecting and repairing boiler fittings, including, without limitation, safety valves, regulators, automatic-control mechanisms, water columns and auxiliary machines.

Craft: BRICKLAYER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

SEE AMENDMENT 1

Bricklayer Journeyman……..……..……51.71
Bricklayer Foreman……..……52.96

ADD ZONE PAY in addition to BRICKLAYER rates add the applicable amounts per hour, calculated based on road miles of over thirty-five (35) miles from the Washoe County Courthouse in Reno, Nevada:

Zone 1	0 to 35 miles	$0.00
Zone 2	35 to 75 miles	$2.50
Zone 3	Over 75 miles	$8.12

ADD PREMIUM PAY

One and one half (1 ½) the regular straight time hourly rate shall be paid:

1. For all hours worked over eight (8) hours in one day or shift.
2. For any hours worked on Saturday from midnight to midnight.

Double the regular straight time hourly rate shall be paid for all time:

1. For all hours worked over twelve (12) hours in one day or shift.
2. For any hours worked on Sunday from midnight to midnight.
3. For any hours worked on holidays from midnight to midnight.

RECOGNIZED HOLIDAYS

If any of these holidays fall on Sunday, the Monday following shall be considered a Holiday.
New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Admission Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB DESCRIPTION: Excerpt from Agreement between No, NV Masonry Contractors and LIUNA Local 169.

This shall apply to and cover the work of Brick/Block Masonry, Stone Masonry, Artificial Masonry Marble Masonry.

Craft: CARPENTER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Carpenter Journeyman..……..……58.42
Carpenter Foreman..……..……..……62.06
Carpenter General Foreman…….……..……66.06

ADD ZONE RATE
(Building and Heavy Highway and Dam Construction)
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

ADD PREMIUM PAY
Any work performed over eight (8) hours per day and on Saturdays shall be compensated at time and one-half (1-1/2x) the appropriate hourly rate. All work performed on Sundays, holidays and over twelve (12) hours in one (1) day shall be compensated at two times (2x) the appropriate hourly rate. In the event a day's work is lost because of severe weather conditions or major mechanical breakdown, work may be performed on a voluntary basis on a Saturday at the straight time hourly rate for eight (8) hours provided the straight time hours worked in one (1) week do not exceed forty (40) hours.

RECOGNIZED HOLIDAYS
New Year's Day, Memorial Day, 4th of July, Labor Day, Admission's Day, Thanksgiving Day, the Friday after Thanksgiving, Christmas Day.

JOB DESCRIPTION Excerpt from Southwest Regional Council of Carpenters and Affiliated Local Unions 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) The character of such work covered by this Agreement shall include but not be limited to all carpenter, concrete form work, shoring, drywall, metal stud, drywall finishing, plaster, scaffold, modular furniture, trade show work, insulation, acoustical, 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……..…….51.92
Cement Mason - Foreman……..……55.55

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	75 to 150 miles	$6.00
Zone 3	150 to 300 miles	$7.00
Zone 4	More than 300 miles	$8.00

ADD PREMIUM PAY
OVERTIME – Any worked performed over eight (8) hours per day shall be compensated at time and one half the hourly rate. All work performed after twelve (12) consecutive hours shall be paid at double the hourly rate. All worked performed on Saturdays shall be compensated at time and one half the hourly rate. All Sunday and Holiday work shall be paid for at double time.

RECOGNIZED HOLIDAYS
New Year's Day, Memorial Day, Independence Day, Labor Day, Admissions Day, Thanksgiving Day and the following Friday following Thanksgiving Day, and Christmas

JOB DESCRIPTIONS
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.
2. All heavy, highway and engineering construction, including but not limited to construction, improvement, modification, demolition, of all or any part of streets and highways (including sidewalks, curbs and gutters), bridges, viaducts, rail roads, tunnels, airports, water supply, irrigation, flood control and drainage systems, sewers and sanitation projects, dams, power houses, refineries, aqueducts, canals, river and harbor projects, wharves, docks, breakwaters, jetties, quarrying of breakwater or rip-rap stone, or operation incidental to such heavy construction work.
3. 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

Communication Technician..…….....41.13

JOB DESCRIPTION:

ELECTRONIC COMMUNICATION TECHNICIAN, includes but is not limited to:
1. Pulling cable, installing and trimming devices, terminating loops, circuits, or other data gathering points;
2. Termination of main control panels, racks, or other head end equipment, as well as testing of all circuits from the field devices to the main control panels and/or equipment; 2016-2017 Prevailing Wage Rates – Washoe County 13
3. Utilizing test equipment for the purpose of troubleshooting and verifying the integrity of the circuits in question;
4. Using hand tools to assemble and install data communication lines and equipment computer systems, antennas and towers;
5. Disassembling equipment to adjust, repair or replace parts using hand tools;
6. Starting up, programming and documenting systems;
7. Measuring, cutting, splicing, connecting, soldering and installing wire and cable associated with communication systems.

Craft: ELECTRICIAN LINEMAN/GROUNDMAN/HEAVY EQUIPMENT OPERATOR
(Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Electrician-Groundman……..……39.57
Lineman-Journeyman…..……..…….....67.30
Lineman-Foreman……..……73.99
Lineman-General Foreman……..……...80.76
Lineman-Equipment Man……..……..51.75

ADD 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.

RECOGNIZED HOLIDAYS
New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Nevada Day, Thanksgiving Day and the Friday following, Christmas Day.

JOB DESCRIPTION:
Outside, overhead and underground construction and maintenance work on electrical transmission lines, switch yards, substations and distribution systems which shall include:

1. 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.

2. 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, shall be performed by workmen under the Agreement. 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.

Street lighting systems where such work properly comes under the outside jurisdiction shall be handled in the same manner as pole line construction.

Installing and maintaining the catenary and trolley work and bonding of rails shall be handled in the same manner as pole line, and steel construction.

In connection with all of the above items, it is understood the scope of this Agreement shall include not only new installation work but shall also govern the repair, maintenance or dismantling of such structures, lines or equipment; the handling and operating of all equipment used to transport men, tools and/or materials on

the job site as well as the equipment used to move, raise or place materials used in the Outside Branch of the Electrical Industry shall be performed by workmen under this Agreement unless otherwise excluded herein.

Craft: ELECTRICIAN – NEON SIGN (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Electrician Neon Sign Journeyman……..…….63.15
Electrician Neon Sign Foreman..……..…….65.15
Electrician Neon Sign Truck Foreman supervising (4) or more...…….67.65

ADD PREMIUM PAY
One and one half (1 ½X) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift, either before or after the shift.
2. For up to 8 hours worked on Saturday from midnight to midnight.
Double (2X) the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over eleven (11) hours in one day or shift, Monday thru Friday.
2. For all hours worked in excess of 8 hours on Saturday, Sundays or Holidays.

SHIFT DIFFERENTIAL
Second Shift (Swing) will be an additional $1.25 cents per hour.
Third Shift (Graveyard) will be an additional $1.50 per hour.
HIGH TIME (Working at heights)
1. All employees working at height of 65 feet and subject to a direct fall shall be paid an additional $2.75 per hour in addition to their normal rate for a minimum of 2 hours.
2. All employees working at height of 125 feet or when repelling below 65 feet shall be paid an additional $4.00 per hour in addition to their normal rate for a minimum of 4 hours.

FOREMAN/TRUCK FOREMAN
1. First employee on the job (TRUCK FOREMAN) must have a CDL and Welder certification and shall be paid $2.00 per hour
in addition to their normal rate of pay.
2. When the first employee on the job (FOREMAN) is supervising (4) or more workers, he or she shall be paid an additional $2.50 per hour. In addition to their normal rate of pay.
3. When the first employee on the job (TRUCK FOREMAN and FOREMAN) has a CDL and Welder certification and is supervising (4) or more workers, he or she shall be paid an additional $4.50 per hour. In addition to their normal rate of pay.

RECOGNIZED HOLIDAYS
New Year's Day, Martin Luther King Day, President's Day unpaid holiday; double time for any hours worked, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Eve ½ day (4 hours) unpaid holiday; straight time for first four hours worked and double time for hours worked after four hours, Christmas Day.

JOB DESCRIPTION Includes but is not limited to:
1. Installing, servicing and repairing plastic, neon and illuminated signs.
2. Ascending ladders or operating hydraulic or electric hoist to install, service, or examine sign to determine cause of malfunction.
3. Wiring, rewiring or removing defective parts and installing new parts using electrician's tools.
4. 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……..……...……..69.61
Wireman-Cable Splicer…...……..75.41
Wireman Forman…..……..……75.41
Wireman General Foreman…..……..……81.21

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 70 miles	$0.00
Zone 2	70 to 90 miles	$8.00
Zone 3	90 miles and over	$10.00

ADD PREMIUM PAY
Premium pay for hours worked in excess of a shift of 8 hours or 12 hours or such other time increment One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift.
2. For the first eight (8) hours worked on Saturday

Double the regular straight time hourly rate shall be paid for all time:
3. For all hours worked over ten (10) hours in one day or shift.
4. For any hours worked on Sunday
5. For any hours worked on Holidays

Shift Rates
1. Swing shift to be paid at seventeen-point three (17.3) percent the regular straight time rate for hours between 4:30 p.m. and 1:00 a.m.
2. Graveyard shift to be paid at thirty-one-point four (31.4) percent the regular straight time rate for hours between 12:30 a.m. and 9:00 a.m.
3. Shifts are established for at least five (5) consecutive days or double the regular straight time rate shall be paid.

**Note – Double the straight time rate is the max rate paid. (No pyramiding of overtime rates)

RECOGNIZED HOLIDAYS
New Year's Day, Memorial Day, Independence Day, Labor Day, Admission Day, Veteran's Day, Thanksgiving Day, Friday following Thanksgiving Day, Christmas Day.

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..……122.16
Elevator Constructor-Journeyman Mechanic In Charge…….....132.63

ADD PREMIUM PAY
Work performed on Construction Work on Saturdays, Sundays and before and after 30 the regular working day on Monday to Friday, inclusive, shall be classed as overtime, and paid for at double the rate of single time.

RECOGNIZED HOLIDAYS
New Year's Day, Memorial Day, Independence Day, Labor Day, Nevada Day, Veteran's Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB DESCRIPTION: Excerpt from Agreement of International Union of Elevator Constructors

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 described in Par. 5(a). 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.

(b) 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.

(c) 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:

1. 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.
2. Balustrade brackets may be shipped attached but not aligned.
3. 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

(d) 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.
(e) The erecting of all guide rails.
(f) 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.
(g) The drilling of overhead beams for attaching machines, sheaves, kick angles, and all other elevator equipment.
(h) The setting of all templates.
(i) All foundations, either of wood or metal, that should take the place of masonry.
(j) The assembly of all cabs complete.
(k) The installation of all indicators.
(1) The erecting of all electrical or mechanical automatic or semi-automatic gates complete.
(m) The hanging of all automatic or semi-automatic elevator hoistway doors, together with the installation of hangers and tracks.
(n) The installation of all devices for opening and closing and locking of elevator car and hoistway doors and gates.
(o) The drilling of doors for mounting of closing devices.
(p) The drilling of angle supports for mounting of closing devices except one template hole.
(q) The drilling of sills for sill trips.
(r) The operating of temporary cars.
(s) The setting of all elevator pressure open or pit tanks.
(t) 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.
(u) All air cushions with the exception of those built of brick or those put together with hot rivets.
(v) Landing door entrances.

Craft: FENCE ERECTOR (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Fence Erector……..……..……48.78

ADD ZONE RATE
In addition to FENCE ERECTOR rates add the applicable amounts per hour, calculated based on a 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

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift.
2. For any hours worked on Saturday from midnight to midnight.

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over twelve (12) hours in one day or shift.
2. For any hours worked on Sunday from midnight to midnight.
3. For any hours worked on holidays from midnight to midnight.

RECOGNIZED HOLIDAYS
If any of these holidays fall on Sunday, the Monday following shall be considered a Holiday.
New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Admission Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB DESCRIPTION:
Includes but is not limited to:
1. Erecting or repairing chain link, wooden, tortoise, wire/wire mesh, or temporary fencing;
2. Mixing and pouring concrete around bases of posts and tamping soil into post hole to embed post;
3. Digging post holes with a spade, post hole digger or power-driven auger;
4. Aligning posts through the use of lines or by sighting;
5. Verifying vertical alignment of posts with a plumb bob or spirit level.

Craft: FLAG PERSON (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Flag Person…….46.66

ADD ZONE RATE
In addition to FLAG PERSON add the applicable amounts per hour, calculated based on a 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

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift.
2. For any hours worked on Saturday from midnight to midnight.

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over twelve (12) hours in one day or shift.
2. For any hours worked on Sunday from midnight to midnight.
3. For any hours worked on holidays from midnight to midnight.

RECOGNIZED HOLIDAYS
If any of these holidays fall on Sunday, the Monday following shall be considered a Holiday.
New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Admission Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB DESCRIPTION
FLAG PERSON, 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;

Craft: FLOOR COVERER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Floor Coverer Journeyman…….57.40
Floor Coverer Foreman…..…….61.14

ADD PREMIUM PAY

Any work performed over eight (8) hours per day and on Saturdays shall be compensated at time and one-half (1-1/2x) the appropriate hourly rate. All work performed on Sundays, holidays and over twelve (12) hours in one (1) day shall be compensated at two times (2x) the appropriate hourly rate. In the event a day's work is lost because of severe weather conditions or major mechanical breakdown, work may be performed on a voluntary basis on a Saturday at the straight time hourly rate for eight (8) hours provided the straight time hours worked in one (1) week do not exceed forty (40) hours.

RECOGNIZED HOLIDAYS

New Year's Day, Memorial Day, Independence Day, Labor Day, Admissions Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB DESCRIPTION: Excerpt from Southwest Mountain States Regional Council of Carpenters.

All work in connection with the installation of floor coverings (with the exception of wood floors which are covered by the Master Labor Agreement) such as measuring, cutting, installing, or removal and other preparation for installation of all types of floor covering. All types of floor covering regardless of material (except wood flooring), including but not limited to all types of carpeting, linoleum, vinyl, cork, laminate floors; glue down wood floor applications; rubber, cork, asphalt, linoleum or other types of tile; artificial turf and sports surfaces; any type of resilient flooring such as epoxy, polyurethane or similar materials regardless of how applied; and ceramic tile and stone. Included in the work covered is the application or installation of any type of moisture barrier and any type of underlayment or subfloor in connection with a flooring installation.

Craft: GLAZIER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Glazier Journeyman……33.70
Glazier Foreman…..…….36.15
Glazier Superintendent..……..…….37.37

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For first two (2) hours worked over eight (8) on a regular five (5) day week.
2. For all hours worked on Saturday. Employees shall not work less than four (4) hours.

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked beyond ten (10) hours shall be paid at two (2 X) times the straight time rate.
2. For all hours worked on Saturday beyond 8 hours (2 X) times the straight time rate.
3. For hours worked Sunday and Recognized Holidays. Employees shall not be employed for less than four (4) hours.

*Also, if there is less than 10 hours between shifts, the 2nd shift becomes an extension of the 1st shift.

*Shift Differential: To be paid for all work performed between the hours of 5:30 pm to 5 am and it will be compensated at 10% differential for all hours worked including overtime. Overtime that falls between these hours will still be paid at the appropriate overtime rate.

20.1 High Pay – work that is thirty (30) or more feet in height above grade on an elevated, mechanically operated platform (including but not limited to: swing stage, boatswain chair, crane basket, heck lift, boom lift), rappelling work, work at slab edge outside the perimeter safety cable or work at slab edge inside the perimeter safety cable if the work being performed puts the employee in a free fall situation because the perimeter safety cable is no longer at or near waist level shall be paid at the rate of one dollar ($1.00) per hour above the straight time rate for actual hours worked. High time shall be paid in addition to all other premiums involved.

25.2 Foremen:
a) The selection of the individual to act as foreman shall be at the discretion of the Employer. On outside jobs lasting three (3) days or more and which four (4) workers or more are employed, one (1) foreman will be designated and he shall be paid ten percent (10%) per hour over the highest journeyman Glazier supervised. Inside foreman shall receive ten percent (10%) per hour above the journeyman's wage scale.

b) When a glazier is requested to perform welding on the job site, he/she will be compensated one dollar ($1.00) over his regular rate of pay. All equipment, including hoods, leather and gloves, will be supplied by the Employer.

RECOGNIZED HOLIDAYS
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB DESCRIPTION: Excerpt from Agreement between DC 16 and Glazing Contractors Associations of NV and Independent Contractors

General Glazing shall include the layout and setting by hand or with machines, cutting, preparing handling or removal of the following and incidental and supplemental to such work: setter of art glass, prism glass, beveled glass, leaded glass, automobile glass, window glass, mirrors of all types, wire glass, ribbed glass, ground glass, colored glass, figured glass, vitrolite glass, carrara glass, and all other types of opaque glass; glass chalk boards, structural glass, tempered and laminated glass, thiokal, neoprene and all other types of glass cements, all types of insulating glass units, solar heat collectors containing glass or glass substitutes, glass hand rail, electric glass, bathroom fixtures, all plastics when used in place of glass, all other similar materials when used in place of moldings, tubber, lead and all types of mastic in wood, iron, aluminum or sheet metal, sash skylights, doors, frames, stone, wall cases, show cases, books cases, sideboards, partitions, automatic doors, automatic sliding doors, revolving doors, luminous ceilings, gaskets, and plastic mirrors, the installation of the above materials, temporary or permanent, on or for any building in the course of repair, remodel, construction or alteration.

The installation of all glass framing or support systems for the same such as extruded, rolled or fabricated metals or any materials that replace the same, such as plastics, metal tubes, mullions, metal facing materials, muttins, facia trim moldings, porcelain panels, skylights, showcase doors and relative materials, including those in any or all of the buildings related to the store front and window wall, curtain wall, stop wall, skylight and dome construction. Glazing and installation of door and window frames, such as patio sliding or fixed doors, vented or fixed windows, shower doors, bath tub enclosures, screens storm stash where the glass becomes an integral part of the finished products, the tinting and coating of glass for the reflecting of heat and light, showcase tops, glass shelving of all types and table tops. In addition, such caulking, glass to glass, glass to metal, metal to concrete and panel to panels.

Production, maintenance, including all incidental and supplemental to, but not limited to Employees, and Employees who are engages int eh cutting, preparing, handling and selecting of glass and /or mirror, bevellers, silverers, blockers, scratch polishers, sand-blasters, flat glass wheel cutters, miters cutters, engraver, hole-drilling machine operations, belt sanding, automatic beveling, multi-grove edging machines, semi- and automatic-cutting machines, grinding, polishing unpacking ad racking or glass, glass packing, glass and mirror cleaning, mirror stripping, all operations in the manufacturing, framing and fabrication and assembling of all insulating units, assembling of all glass insulated solar heat collectors containing glass or glass substitutes, molding or mirrors, manufactured and assembly of sliding glass or mirror doors, the operating of all machines and equipment for these operations, oven operations, glass hangers, glass benders and operators, safety glass fabricators, inspectors, janitors, maintenance mechanics, loading and unloading or truck and railroad cars.

Craft: Highway Striper (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Highway Striper……51.28
Highway Striper Foreman……51.78

ADD ZONE RATE
In addition to HIGHWAY STRIPER rates add the applicable amounts per hour, calculated based on a 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

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift.
2. For any hours worked on Saturday from midnight to midnight.

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over twelve (12) hours in one day or shift.
2. For any hours worked on Sunday from midnight to midnight.
3. For any hours worked on holidays from midnight to midnight.

RECOGNIZED HOLIDAYS
If any of these holidays fall on Sunday, the Monday following shall be considered a Holiday.
New Year's Day, Memorial Day, 4th of July, Labor Day, Admission Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB DESCRIPTION:
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;

Craft: Hod Carrier-Brick Mason Tender (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Brick Mason Journeyman……..49.03
Brick Mason Foreman……49.43

ADD ZONE RATE
In addition to Hod Carrier Brick Mason 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	$8.13

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift.
2. For any hours worked on Saturday from midnight to midnight.

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over twelve (12) hours in one day or shift.
2. For any hours worked on Sunday from midnight to midnight.
3. For any hours worked on holidays from midnight to midnight.

RECOGNIZED HOLIDAYS
If any of these holidays fall on Sunday, the Monday following shall be considered a Holiday.
New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Admission Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

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

Plasterer Tender-Journeyman..……..49.37
Plasterer Tender- Gun Tender..……..50.37
Plasterer Tender-Foreman…….……50.73

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	$8.00

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift.
2. For any hours worked on Saturday from midnight to midnight.

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over twelve (12) hours in one day or shift.
2. For any hours worked on Sunday from midnight to midnight.
3. For any hours worked on holidays from midnight to midnight.

RECOGNIZED HOLIDAYS
If any of these holidays fall on Sunday, the Monday following shall be considered a Holiday.
New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Admission Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

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.

For sprayed on fire proofing work only, including Monocoat, Cafco or other materials for the same or similar use an Employer signatory to this Agreement and the Local 169, Laborers Master Agreement may employ Laborers at the Group 1 wage rate to perform overspray protection, the spreading of all temporary protective drop cloths, building paper or plastic covers and taping of same, the cleaning of all floors, and debris, cold weather protection and cure including but not limited to handling installing or tending to blankets, visqueen, and space heaters and moving rolling scaffolding.

Craft: Ironworker (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

SEE AMENDMENT 2

Ironworker-Journeyman……81.01
Ironworker - Foreman…..……..……85.63
Ironworker -General Foreman……..……90.71

ADD ZONE RATE

In addition to Iron Worker rates add the applicable amounts per day, calculated based on a road mile from the Reno City Hall or Las Vegas City Hall.

Zone 1	60 to 75 miles	$20.00
Zone 2	75 to 100 miles	$25.00
Zone 3	100 miles and over	$75.00

ADD PREMIUM PAY

One and one half (1X) the regular straight time hourly rate shall be paid:
1. For the first two (2) hours worked in excess of eight (8) on a regular workday Monday-Friday
2. For the first eight (8) hours on Saturday

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over ten (10) hours in one day or shift.
2. For any hours worked on Sunday.
3. For all hours worked over eight (8) on Saturday
4. For all hours worked on Holidays

Shift Pay
1. 2nd shift add 6% of hourly wage
2. 3rd shift add 13% of hourly wage
3. Dedicated shift add 6% of hourly wage

RECOGNIZED HOLIDAYS

New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB CLASSIFICATION: Excerpt from Agreement between NV AGC and DC of Ironworkers

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

SEE AMENDMENT 9

Landscaper ……..…….43.37
Furniture Mover ……..…….44.87
Group 1……..…….48.53
Group 1A……..…….46.66
Group 2……..…….48.63
Group 3……..…….48.78
Group 3A……..……..52.21
Group 4……..…….49.03
Group 4A……..……..51.53
Group 5…..…….49.33
Group 6
Nozzlemen, Rodmen……..…….48.33
Gunmen, Materialmen……..…….48.33
Reboundmen..……..…….48.68
Gunite Foreman..……..…….49.73

ADD ZONE RATE
In addition to LABORER rates add the applicable amounts per hour, calculated based on a 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

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift.
2. For any hours worked on Saturday from midnight to midnight.

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over twelve (12) hours in one day or shift.
2. For any hours worked on Sunday from midnight to midnight.
3. For any hours worked on holidays from midnight to midnight.

RECOGNIZED HOLIDAYS
If any of these holidays fall on Sunday, the Monday following shall be considered a Holiday.
New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Admission Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

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 GROUP CLASSIFICATIONS

Craft: LUBRICATION AND SERVICE ENGINEER (MOBILE AND GREASE RACK) (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

SEE AMENDMENT 3

Lubrication and Service Engineer (mobile and grease rack)……..71.43

ADD ZONE RATE

In addition to: **LUBRICATION AND SERVICE ENGINEER (MOBILE AND GREASE RACK)** rates add the applicable amounts per hour calculated based on a road miles from the Carson City Courthouse or Washoe County Courthouse.

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$5.00
Zone 3	150 to 300 miles	$6.00
Zone 4	300 miles and over	$7.00

ADD PREMIUM PAY

1. One and one-half (1-1/2) times the applicable straight-time rate for the day, shift, work, equipment and classification shall be paid for all work (including repair work and field survey 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 time shall be paid.

2. Overtime. The following rates shall apply on Sundays and holidays and all work before a shift begins and after it ends:

RECOGNIZED HOLIDAYS

Holidays. Double the applicable straight-time rate shall be paid for all work (including repair, maintenance and field survey work) performed on Sundays and the following holidays: New Year's Day (January 1); Memorial Day (last Monday in May); Independence Day (July 4); Labor Day (1st Monday in September); Nevada Admission Day (last Friday in October); Thanksgiving Day (4th Thursday in November); the day after Thanksgiving Day; and Christmas Day (December 25). Holidays falling on Sunday shall be observed on the following Monday. Holiday hours shall be reckoned on the same basis as Sunday hours.

Saturday Shift Period. On any shift, Saturday shall be the twenty-four-hour period commencing at 12:00 midnight Friday.

Sunday Shift Period. On any shift, Sunday shall be the twenty-four-hour period commencing at 12:00 midnight Saturday.

3. For hours worked in excess of 12) on any such workday, an Employee shall be paid two (2) times the regular straight-time rate of pay for each hour so worked.

Craft: Mechanical Insulator (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Mechanical Insulator-Mechanic…….....……..75.52
Mechanical Insulator-Foreman….. ...……79.52
Mechanical Insulator-General Foreman ..……81.52

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	$15.00
Zone 2	21 to 40 miles	$25.00
Zone 3	41 to 60 miles	$35.00
Zone 4	Over 60 miles	$100.00
Zone 4: Up to $140.00 per day with receipts		

ADD PREMIUM PAY
One and one half 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 the minimum hourly wage rate shall be paid for all other overtime worked Monday through Friday and in excess of ten (10) hours on Saturdays.

RECOGNIZED HOLIDAYS
New Year's Day, President's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas 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.

65. Lining of all mechanical room surfaces and air handling shafts.
66.The filling and damming of fire stops and penetrations including, but not limited to, electrical and mechanical systems.
67. All foam applications for the purpose of thermal, acoustical, or fire protective purposes, including RTV foams or equivalents, applied to mechanical or electrical systems.
68. 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.
69. The insulation of all field joints on pre-insulated underground piping, and the pouring of Gilsilite or its equivalent.
70. Any finish material which is contiguous to the thermal or acoustical application.
71. 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.
72. 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.
73. The Agreement shall cover all other work of a specialty nature.

Craft: MILLWRIGHT (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Millwright Journeyman…..……..……73.97
Millwright Welder…..……..……76.97
Millwright Foreman.……..……78.46
Millwright General Foreman..……..……83.40

ADD ZONE RATE

In addition to MILLWRIGHT rates add the applicable amounts per hour, calculated from Reno, Nevada City Hall. The Employer agrees to provide each employee zone pay as established below if the project is further than forty-five (45) miles calculated via the "shortest route" filter using Google Maps from the address of city hall of respective dispatch points.

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 (1½) times the straight-time rate of pay. All additional overtime will 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.

Lodging: If the project is further than forty-five (45) miles calculated via the "shortest route" filter using Google Maps from the address of city hall of the respective dispatch points listed above, the Employer agrees to furnish acceptable single occupancy lodging to each employee. Employers are encouraged to use commercial facilities and lodges, however, when such facilities are not available, per diem in lieu of room and lodging shall be paid at the rate of one hundred ten dollars ($110.00) per day, or part thereof, from the date of hire for the project to the date of termination of employment on the project.

RECOGNIZED HOLIDAYS

New Year's Day, Washington's Birthday (President's Day), Memorial Day, 4th of July, Labor Day, Veteran's Day, Thanksgiving Day, Friday after Thanksgiving, Christmas Day.

JOB DESCRIPTION Excerpt from Southwest Regional Council of Carpenters' Millwright Regional Master Construction Agreement.

Section 1.4 Millwright Jurisdiction.
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.

Section 1.4.1
Millwright craft jurisdiction shall include the 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.

Section 1.4.2
Millwright craft jurisdiction shall include 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.

Section 1.4.3
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.

Section 1.4.4
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.

Section 1.4.5
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.

Section 1.4.6
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.

Section 1.4.7
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.

Section 1.4.8
Incidental asbestos removal on equipment in which Millwrights normally remove during maintenance and repair work.

Section 1.4.9
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

SEE AMENDMENT 3

Operating Engineers	(SEE GROUP CLASSIFICATIONS)
Group 1	66.41
Group 1A	69.17
Group 2	69.70
Group 3	69.97
Group 4	70.71
Group 5	71.01
Group 6	71.18
Group 7	71.43
Group 8	72.02
Group 9	72.34
Group 10	72.69
Group 10A	72.88
Group 11	73.12
Group 11A	74.76
Group 11B	75.57
Foreman	74.76

Add 12.5% to base rate for “Special” 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

SEE AMENDMENT 3

Operating Engineers	(SEE GROUP CLASSIFICATIONS)
Group 1	81.71
Group 1 Truck Crane Oiler	75.54
Group 1 Oiler	73.58
Group 2	80.20
Group 2 Truck Crane Oiler	75.29
Group 2 Oiler	73.37
Group 3	78.96
Group 3 Truck Crane Oiler	75.07
Group 3 Oiler	73.15
Group 3 Hydraulic	74.74
Group 4	77.23
Group 5	76.13

Add 12.5% to base rate for “Special” Shift

Add Operating Engineers Zone Pay
Add Premium Pay

Craft: OPERATING ENGINEER (Union Rate)
PILEDRIVER

Prevailing wage rates include the base rate as well as all applicable fringes

SEE AMENDMENT 3

Operating Engineers (SEE GROUP CLASSIFICATIONS)
Group 1……81.18
Group 1 Truck Crane Oiler……75.72
Group 1 Oiler……73.80
Group 2……79.64
Group 2 Truck Crane Oiler……75.51
Group 2 Oiler……73.60
Group 3……78.19
Group 3 Truck Crane Oiler……75.29
Group 3 Oiler……73.37
Group 4……76.68
Group 5……75.57
Group 6……72.29
Group 7……73.50
Group 8……72.54
Add 12.5% to base rate for "Special" Shift……

ADD ZONE RATE

In addition to: **OPERATING ENGINEER, STEEL FABRICATOR & ERECTOR, and OPERATING ENGINEER PILEDRIVER,** rates add the applicable amounts per hour calculated based on a road miles from the Carson City Courthouse or Washoe County Courthouse

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$5.00
Zone 3	150 to 300 miles	$6.00
Zone 4	300 miles over	$7.00

ADD PREMIUM PAY

1. One and one-half (1-1/2) times the applicable straight-time rate for the day, shift, work, equipment and classification shall be paid for all work (including repair work and field survey 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 time shall be paid.

2. Overtime. The following rates shall apply on Sundays and holidays and all work before a shift begins and after it ends:

RECOGNIZED HOLIDAYS

Holidays. Double the applicable straight-time rate shall be paid for all work (including repair, maintenance and field survey work) performed on Sundays and the following holidays: New Year's Day (January 1); Memorial Day (last Monday in May); Independence Day (July 4); Labor Day (1st Monday in

September); Nevada Admission Day (last Friday in October); Thanksgiving Day (4th Thursday in November); the day after Thanksgiving Day; and Christmas Day (December 25). Holidays falling on Sunday shall be observed on the following Monday. Holiday hours shall be reckoned on the same basis as Sunday hours.

Saturday Shift Period. On any shift, Saturday shall be the twenty-four-hour period commencing at 12:00 midnight Friday.

Sunday Shift Period. On any shift, Sunday shall be the twenty-four-hour period commencing at 12:00 midnight Saturday.

3. For hours worked in excess of 12) on any such workday, an Employee shall be paid two (2) times the regular straight-time rate of pay for each hour so worked.

JOB DESCRIPTION, 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.

Craft: PAINTER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Brush/Roller Painter……..……..49.79
Spray Painter/Paperhanger……..……51.50
Sandblaster...……..……. 51.55
Structural Steel & Steeplejack……..……51.55
Swing Stage……..……..……49.30
Special Coating Application-Brush……..……49.35
Special Coating Application-Spray……..……49.35
Special Coating Application-Spray Steel..……..…… 53.29
Foreman..……$1.00 above highest Journeyman

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:

1. For all hours worked over eight (8) hours in one day or shift unless the Union is notified when four (4) tens (10's) are instituted.
2. For any hours worked on Saturday from midnight to midnight
3. For any work performed in excess of the regular work week of forty (40) hours.

Double the regular straight time hourly rate shall be paid for all time:
1. For any hours worked on Sunday from midnight to midnight
2. For any hours worked on holidays from midnight to midnight

RECOGNIZED HOLIDAYS
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB DESCRIPTION: Excerpt from Agreement between Painters and Allied Trades DC 16 and Independent Flooring Contractors of No Nevada

a. All painting of residences, buildings, structures, industrial plants, tanks, vats, pipes, vessels, bridges, light poles, high tension poles, traffic and parking lines on highways, parking lots, playgrounds, factories, and air line strips; all sign, pictorial, coach, car automobile, carriage, aircraft machinery, ship and railroad equipment, mural and scenic painting; spackling of all surfaces where adhesive materials are used; and all drywall pointing, taping and finishing.

b. All decorators, paperhangers, hard wood finishers, grainers, glaziers, varnishers, enamellers

1. Paperhangers work shall be all material of whatever kind or quality applied to walls or ceilings with paste or adhesive; all tacking on the muslin or other materials which is used as wall or ceiling coverings or covered with material pasted on.

2. The scraping off of old paper, preparing of walls, etc., for paper hangers work.

3. The application of relief, stucco, plaster or decorative work shall not be considered paperhanger's work exclusively.

(c) All men engaged in applying or removing paints, pigments, extenders, metal primers and metal pigments, clear pigments, binders, thinners and dryers, primers and sealers, oil paints and enamels, water

colors and emulsions, clear coatings, waxes, stains, mastics, cement enamels and other special coatings, plastics, adhesives, coatings and sheet rubber and other linings, oils, varnishes, water colors, wall paper, wall coverings or other materials used in the various branches of the trade, and the cleaning and bleaching of all interior and exterior walls and surfaces with liquid, steam, sandblast or any other process and all work incidental thereto.

Craft: PILEDRIVER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Piledriver-Journeyman……..58.92
Piledriver-Welder……..59.92
Piledriver-Foreman…..62.61
Piledriver-General Foreman……..66.67
Tender……..... 62.61
Stand-By Diver……..63.61
Diver-Diving (Wet Pay)…….. 105.18

ADD ZONE RATE
In addition to PILEDRIVER rates add the applicable amounts per hour, calculated from the Washoe County Courthouse:

Zone 1	Within 75 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

Workmen 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.

ADD PREMIUM PAY
First two (2) hours outside the regular constituted shift shall be at the rate of time and one-half (1½X). Saturdays up to the first twelve (12) hours shall be at the rate of time and one-half (1½X). All additional hours and Sundays and holidays shall be the rate of double time (2X). No work shall be performed on Labor Day, except to preserve life and property.

RECOGNIZED HOLIDAYS
New Year's Day, Memorial Day, 4th of July, Labor Day, Admission Day, Thanksgiving Day, the Friday after Thanksgiving, Christmas Day.

JOB DESCRIPTION
104.1 The Carpenters claim the layout, rigging, tagging, signaling, cutting, burning, welding, chain sawing, driving, setting and pulling of all soldier piles and soldier beams together with all necessary waling, shoring, underpinning, struts, bracing, capping and lagging necessary for construction of subterranean structures of all types to include, but not limited to subways, subway stations, buildings, storm drains, sewers, pipelines and all open cut and cover construction projects. The Carpenters further claim construction of all covers and access mats to include all necessary rigging for setting and removing, whether intermittently or regularly and installation and removal of timber decking.
(a) In addition to the work identified in Article I, the Pile Divers claim the operation of the following types of equipment when the operation of same is incidental to that work which falls under the jurisdiction of the United Brotherhood of Carpenters and Joiners of America or Pile Drivers Local Union No. 2375; mechanical forklifts of all types, boom trucks and any other mobile equipment as assigned by the employer necessary to complete the work. In addition, the operation of the power pack and vibratory hammer controls when driving or pulling, sheet pile, pile, soldier beams, cassinos or casing. . The work includes work on cast & drill holes and operation of the ABI machine.
(1) In the construction of waterfront and marine facilities, such as docks, piers, wharves, bulkheads, jetties, and similar structures, the pile driver classification should continue to apply, up to and including the decking thereof.

(2) On all pile driving and caisson work on both land and water, the Pile Driver classification should apply.
(3) In the construction of wooden bridges whether over land or over water, when composed of heavy timber, the Pile Driver classification should apply.
(4) In the construction of concrete or steel bridges over land, the Pile Driver classification shall apply to the driving of piles and/or caisson work including the forms required for the capping of the piles or caissons immediately top of the piles or caissons. The capping of the piles is herein interpreted as being that concrete, wood, or other material resting on the top of the piles where driven or placed and does not include any further form work above the capping. In many instances it has been found that the capping is called the girder. The above shall apply on such concrete or steel bridges constructed over land, highways, railroads, overpasses and include cloverleafs, interchanges, etc.
(5) In the construction of concrete or steel bridges over water, the Pile Driver classification shall apply up to and including all of the form work to the top of the column, piers, or abutments supporting the steel and/or any other superstructures.
(6) In the erection of false work, when necessary for the support of work under the Pile Driver classification, then such false work shall fall within their classification. False work necessary for the support of work under the Carpenter classification shall be done within such Carpenter classification, with the exception that where pile driving or power equipment is used for heavy timber false work, then such work shall come under the Pile Driver classification. This would include all rigging, signaling and tagging incidental to the placing of the heavy timber.
(7) In the construction of open-cut sewers, the Pile Driver classification shall apply on all piling including wood, steel or concrete sheet piling, all bracing timber and form work incidental to the construction thereof.

Craft: PLASTERER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Plasterer-Journeyman……..……...……52.62
Plasterer-Foreman……..……...……55.93

ADD ZONE RATE
In addition to PLASTERER rates add the applicable amounts per hour, calculated from the 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
OVERTIME Eight (8) consecutive hours (exclusive of a meal period) shall constitute a day's work at straight time. Five (5) consecutive days of eight (8) consecutive hours (exclusive of a meal period), Monday through Friday, shall constitute a week's work. One and one half (1 ½) the regular straight time hourly rate shall be paid for all work over eight (8) hours. Sunday will be paid at double the regular straight time rate.

RECOGNIZED HOLIDAYS
All work performed on the following holidays shall be paid for at double the regular straight time rate: New Year's Day, Memorial Day, Fourth of July, Labor Day, Admissions Day, Thanksgiving Day and the Friday after Thanksgiving and also Christmas Day.

If any of the above holidays fall on Sunday, the Monday following shall be considered a holiday.

No work shall be permitted on the Fourth of July or Labor Day, regardless of compensation or donation, except in case of emergency or to protect life and property. Permission to work shall be granted by the representative of the Union or its officer.

JOB DESCRIPTION: Excerpt from Agreement No NV. Plasterers Master Labor Agreement

This includes but is not limited to:
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 structures,

2. 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.

3. All work processes which represent technological change, replacement, modification or substitution for the work described above. In addition, all work and use of new materials or *2020-2024 Reno Plasterers Master Labor Agreement* 4 techniques involved in plaster construction including but not limited to what is known as green or sustainable construction technology.

Craft: PLUMBER/PIPEFITTER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Plumber/Pipefitter-Journeyman..……...……..71.10
Plumber/Pipefitter-Foreman.……...……75.79
Plumber/Pipefitter-General Foreman.……..……80.48

ADD ZONE RATE
In addition to PLUMBER/PIPEFITTER rates add the applicable amounts 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.

Zone 1	0 to 75	$0.00
Zone 2	Over 75 miles	$8.00

ADD 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.

RECOGNIZED HOLIDAYS
New Year's Day, Memorial Day, Fourth of July, Labor Day, Nevada Admission Day, Thanksgiving Day, the Friday after Thanksgiving Day, Day Before Christmas and Christmas Day and any Friday preceding a Holiday falling on a Saturday, if worked, holidays shall be compensated at the double time rate.

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 hearing 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 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…….……..…… 64.64
Refrigeration -Foreman…….……..……68.53
Refrigeration -General Foreman ……..……..……72.41

ADD 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.

RECOGNIZED HOLIDAYS
New Year's Day, Memorial Day, Fourth of July, Labor Day, Nevada Admission Day, Thanksgiving Day, the Friday after Thanksgiving Day, Day Before Christmas and Christmas Day and any Friday preceding a Holiday falling on a Saturday, if worked, holidays shall be compensated at the double time rate.

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 hearing 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 (Non-Union Rate)
(Does not include sheet metal roofs)

Prevailing wage rates include the base rate as well as all applicable fringes

Roofer-Journeyman……..……...……...……33.64

JOB DESCRIPTION

Includes but is not limited to:

1. Installing and covering roofs and structures with slate, asphalt, wood and other related materials, other than sheet metal, by using brushes, knives, punches, hammers and other tools;
2. Spraying roofs, sidings and walls with material to bind, seal, insulate or soundproof sections of a structure;
3. Installation of all plastic, slate, slag, gravel, asphalt and composition roofing, and rock asphalt mastic when used for damp and waterproofing;
4. Installation of all damp resisting preparations when applied on roofs with mop, three-knot brush, roller, swab or spray system;
5. All types of preformed panels used in waterproofing;
6. Handling, hoisting and storing of all roofing, damp and waterproofing materials;
7. The tear-off and/or removal of roofing and roofing materials.

Craft: SHEET METAL WORKERS (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Sheet Metal Worker Journeyman……..…….73.87
Sheet Metal Worker Foreman…….…….....78.26
Sheet Metal Worker General Foreman……..…….…82.65

ADD ZONE RATE
In addition to SHEET METAL 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 the employee shall be provided reasonable lodging and meal expenses.

ADD PREMIUM PAY
All hourly rates are subject to Over Time (One and one half 1 ½) of the Regular rate:
1. For all hours worked over Eight (8) Hours in one day or shift.
2. For the first Eight (8) Hours work on Saturday.

All hourly rates are subject to Double Time of the Regular Rate:
1. For all hours worked over Ten (10) Hours in one day or shift.
2. For all hours worked over Eight (8) Hours on Saturday.
3. For all hours worked on Sunday, New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Nevada Day, Thanksgiving Day, Day after Thanksgiving, Day before Christmas, and Christmas Day.

RECOGNIZED HOLIDAYS
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Nevada Day, Thanksgiving Day, Day after Thanksgiving, Day before Christmas, and Christmas Day

JOB DESCRIPTION: Excerpt from Sheet Metal Local 26 Collective Bargaining Agreement

(a) 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; (b) all lagging over insulation and all duct lining; (c) testing and balancing of all air-handling equipment and duct work; (d) 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; (e) metal exterior wall systems, metal roofing; and (f) 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

Soil Tester (Certified)……..…….46.81
Soils and Materials Tester..…….46.81

Craft: SPRINKLER FITTER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Sprinkler Fitter-Journeyman……..…….65.31
Sprinkler Fitter Foreman……..……...68.31
Sprinkler Fitter General Foreman…….70.56

ADD ZONE RATE
In addition to SPRINKLER FITTER rates add the applicable amounts per hour, calculated based on a road from the courthouse in Reno, Nevada:

Zone 1	0 to 60 miles	$0.00
Zone 2	60 to 80 miles	$23.00
Zone 3	80 to 100 miles	$33.00
Zone 4	Over 100 miles	$125.00

JOB DESCRIPTION
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.

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Rodman/Chainman ……..……...……..69.97
Instrumentman……..……..……...……..71.43
Chief of Party Surveyor……..……..……..72.69

ADD ZONE RATE

In addition to: **OPERATING ENGINEER, STEEL FABRICATOR & ERECTOR, and OPERATING ENGINEER PILEDRIVER,** rates add the applicable amounts per hour calculated based on a road mile from the Carson City Courthouse or Washoe County Courthouse

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$5.00
Zone 3	150 to 300 miles	$6.00
Zone 4	300 miles over	$7.00

ADD PREMIUM PAY

1. One and one-half (1-1/2) times the applicable straight-time rate for the day, shift, work, equipment and classification shall be paid for all work (including repair work and field survey 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 time shall be paid.
2. Overtime. The following rates shall apply on Sundays and holidays and all work before a shift begins and after it ends:

Saturday Shift Period. On any shift, Saturday shall be the twenty-four-hour period commencing at 12:00 midnight Friday.

Sunday Shift Period. On any shift, Sunday shall be the twenty-four-hour period commencing at 12:00 midnight Saturday.

3. For hours worked in excess of 12 on any such workday, an Employee shall be paid two (2) times the regular straight-time rate of pay for each hour so worked.

RECOGNIZED HOLIDAYS

Holidays. Double the applicable straight-time rate shall be paid for all work (including repair, maintenance and field survey work) performed on Sundays and the following holidays: New Year's Day (January 1); Memorial Day (last Monday in May); Independence Day (July 4); Labor Day (1st Monday in September); Nevada Admission Day (last Friday in October); Thanksgiving Day (4th Thursday in November); the day after Thanksgiving Day; and Christmas Day (December 25). Holidays falling on Sunday shall be observed on the following Monday. Holiday hours shall be reckoned on the same basis as Sunday hours.

JOB DESCRIPTION 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……..……..56.76
Taper-Foreman…..……..……..60.83

ADD ZONE RATE
In addition to: TAPER rates add the applicable amounts per hour Zone Pay shall commence from the Washoe County Courthouse in Reno, Nevada, and shall be paid as follows:

Zone 1	0 to 40 miles	$0.00
Zone 2	40 to 60 miles	$2.50
Zone 3	over 60 miles	$4.25

RECOGNIZED HOLIDAYS
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day. When holiday falls on a Sunday, the Monday following shall be observed as the holiday; holidays falling on Saturday shall be observed on the prior Friday.

ADD PREMIUM PAY
All overtime, except Sundays and holidays, will be time and one-half (1 1/2).
Sundays and holidays will be paid double time (2X). Any and all work performed in excess of the regular workday of eight (8) hours, or ten (10) hours if mutually agreed to, and the regular workweek of forty (40) hours shall be considered overtime and shall be paid for at one and one-half (1 1/2) times the regular hourly rate.

JOB DESCRIPTION: Excerpt from Agreement between DC 16 and the independent Drywall Contractors of Northern Nevada

SECTION 1 -- The scope of work covered by this Agreement 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 covered by this Agreement 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 (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Tile Setter/Terrazzo Worker/Marble Mason - Finisher..……40.32
Tile Setter/Terrazzo Worker/Marble Mason - Finisher Foreman……..……41.57
Tile Setter/Terrazzo Worker/Marble Mason Finisher- General Foremen…….……43.32

ADD PREMIUM PAY

All work in excess of forty (40) hours during the established work week shall be paid at the rate of one and one-half (1-1/2) times the hourly base wage rate in effect.

Employees shall be paid one and one-half (1-1/2) times the hourly wage rate for al hours worked over eight (8) in a single day and double time after ten (10) hours in a single day, Monday through Friday, except recognized holidays.

Daily Overtime Saturdays the first ten (10) hours performed on Saturday shall be paid at one and one-half (1-1/2) times the straight time wage rate.

Daily Overtime Sunday- Employees shall be paid double time on Sundays if forty (40) straight time hours have been worked during the proceeding work week.

Holidays shall be paid double time for hours owed on recognized holidays.

RECOGNIZED HOLIDAYS
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day. Any holiday falling on a Sunday will be observed on Monday.

JOB DESCRIPTION: Excerpt from Agreement between BAC 13 Nevada of the Mountain West Administrative District Council Master Labor Agreement

FINISHER'S WORK:

Finisher's work shall consist of assisting, helping or supporting the tile, marble and terrazzo mechanic by performing their historic and traditional work assignments. required to complete the proper installation of the work covered by Sections 5, 7 and 8 of this Code.

Craft: TILE SETTER/TERRAZZO WORKER/MARBLE MASON (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Tile Setter - Journeyman……...……....50.37
Tile Setter - Foreman…….……...……..51.62
Tile Setter - General Foreman…. ……...……. 53.37

Terrazzo/Marble Mason - Journeyman ……...…….....51.87
Terrazzo/Marble Mason - Foreman ……...…….……..53.12
Terrazzo/Marble Mason - General Foreman..……...……..54.87

ADD ZONE RATE
In addition to TILE SETTER/TERRAZZO WORKER/MARBLE MASON rates add the applicable amounts per hour, calculated based on a road miles of over fifty (50) miles from the Washoe County Courthouse in Reno, Nevada:

Zone 1	0 to 50 miles	$0.00
Zone 2	50 to 75 miles	$3.75
Zone 3	Over 70 miles	$8.13

ADD PREMIUM PAY

All work in excess of forty (40) hours during the established work week shall be paid at the rate of one and one-half (1-1/2) times the hourly base wage rate in effect.

Employees shall be paid one and one-half (1-1/2) times the hourly wage rate for all hours worked over eight (8) in a single day and double time after ten (10) hours in a single day, Monday through Friday, except recognized holidays.

Daily Overtime Saturdays the first ten (10) hours performed on Saturday shall be paid at one and one-half (1-1/2) times the straight time wage rate.

Daily Overtime Sunday- Employees shall be paid double time on Sundays if forty (40) straight time hours have been worked during the proceeding work week.

Holidays shall be paid double time for hours owed on recognized holidays.

RECOGNIZED HOLIDAYS
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day. Any holiday falling on a Sunday will be observed on Monday.

JOB DESCRIPTION: Excerpt from Agreement between BAC 13 Nevada of the Mountain West Administrative District Council Master Labor Agreement

TILE LAYERS' WORK:

Tile laying shall consist of, but not be limited to, the following work procedures and installation of the following materials:

A. The laying, cutting or setting of all tile where used for floors, walls, ceilings, walks, promenade roofs, stair treads, stair risers, facings, hearths, fireplaces, and decorative inserts, together with any marble plinths, thresholds or window stools used in connection with any tile work; also, preparing and setting all concrete, cement, brickwork, or other foundation or materials that may be required to properly set and complete such work; setting or bedding all tiling, stone, marble, composition, glass, mosaic, or other materials forming the facing, hearth or fireplace of a mantel, or the mantel complete, together with setting of all cement, brickwork, or other materials required in connection with the above work; also the slabbing and fabrication of tile mantels, counters and tile panels of every description, and the erection and installation of same; the building, shaping, forming, construction or repairing of all fireplace work, whether in connection with a mantel hearth facing or not, and the setting and preparing of all material, such as cement, plaster, mortar, brickwork, iron work or other materials necessary for the proper and safe construction and completion of such work, except that a mantel made exclusively of brick, marble or stone, shall be conceded to be bricklayers', marble setters' or stonemasons' work, respectively.

B. It will be understood that the word "tile" refers to all burned clay products, as used in the tile industry, either glazed or unglazed, and to all composition materials made in single units up to 15"x20"x2", except quarry tiles larger than 9"x9"x1 1/4", also to mixtures in tile form of cement, plastics and metals that are made for and intended for use as a finished floor surface, whether upon interior or exterior floors, stair treads, promenade roofs, garden walks, interior walls, ceilings, swimming pools, and all places where tile may be used to form a finished surface for practical use, sanitary finish or decorative purposes, for setting all accessories in connection therewith, or for decorative inserts in other materials.

C. All terra cotta called unit tile in sizes of 6"x12" or under, regardless of method of installation, quarry tile 9"x9"x1 1/4" or less; split brick or quarry tile or similar material where the bed is floated or screeded and the joints grouted. Where the work is installed by tile layers, the grouting and cleaning shall be supervised by the mechanic. The bedding, jointing, and pointing of the above materials shall be the work of the craft installing the same. All clay products known as terra cotta tile, unit tile, ceramic veneer and machine-made terra cotta, and like materials in sizes 6"x12" and less regardless of the method of installation. Where the preponderance of materials to be installed comes within the provisions of this Section and when there is also some material in excess of the sizes provided for in this Section, the tile setter shall install all such materials.

D. The preparation, setup, calibration, operation, cleaning, and routine maintenance of any mechanical devices or robotics used to install tile and related materials, or that otherwise assist the tile layer 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 tile and related materials.

Craft: TRAFFIC BARRIER ERECTOR (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Traffic Barrier Erector…….48.53

ADD ZONE RATE
In addition to LABORER rates add the applicable amounts per hour, calculated based on a 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	$5.00
Zone 3	150 to 300 miles	$6.00
Zone 4	300 miles and over	$7.00

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift.
2. For any hours worked on Saturday from midnight to midnight.

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over twelve (12) hours in one day or shift.
2. For any hours worked on Sunday from midnight to midnight.
3. For any hours worked on holidays from midnight to midnight.

RECOGNIZED HOLIDAYS
If any of these holidays fall on Sunday, the Monday following shall be considered a Holiday.
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

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;

Craft: Truck Driver (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Dump Trucks (Single or Multiple Units Including Semi's & Double Transfer Units), Dumpcretes and Bulk Cement Spreader)

Under 4 yds. (water level)……32.25
4 yds. & under 8 yds. (water level)……32.25
8 yds. & under 18 yds. (water level)……32.25
18 yds. & under 25 yds. (water level))……32.25
25 yds. & under 60 yds. (water level)……32.25
60 yds. & under 75 yds. (water level))……32.25
75 yds. & under 100 yds. (water level))……32.25
100 yds. & under 150 yds. (water level))……32.25
150 yds. & under 250 yds. (water level))……32.25
250 yds. & under 350 yds. (water level))……32.25
350 yds. & over (water level)……32.25

Transit Mix

Under 8 yrds……32.25
Under 8 yrds & including 12 yrds……32.25
Over 12 yrds……32.25

Transit Mix (Using Boom)

Transit mix with boom shall receive 16 cents per hour above the appropriate yardage classification rate of pay when such boom is used……32.25

Water & Jetting Trucks

Up to 2,500 gallons……32.25
Up to 2,500 gallons & over……32.25
DW 20's & 21's & other similar Cat type, Terry Cobra LeTourneau pulls, Tournerocker, Euclid, & similar type equipment when pulling Aqua/Pak, Water Tank Trailers, & Fuel, and/or Grease Tank Trailer, or other miscellaneous Trailers, (except as defined under "Dump Trucks")
Heavy Duty Transport (High Bed)……32.25
Heavy Duty Transport(Gooseneck low bed)……32.25
Tiltbed or Flatbed Pull Trailers.. ……32.25
Bootman, Comb. Bootman & Road Oiler……32.25
Flat Rack (2 or 3 axle unit)……32.25

Bus & Manhaul Drivers

Up to 18,000 lbs. (single unit)……32.25
18,000 lbs. and over ……32.25
Warehousemen Spotter ……32.25

Winch Truck & "A" Frame Drivers

Up to 18,000 lbs. ……32.25
18,000 lbs. and over……32.25
Warehousemen Spotter……32.25
Warehouse Clerk……32.25
Tire Repairmen……32.25
Truck Repairmen……32.25
Pick Up Truck & Pilot Cars (Jobsite) ……32.25
Pick Up Truck & Pilot Cars (Over the road) ……32.25
Truck Oil Greaser……32.25
Fuel Truck Driver……32.25
Fuel Man & Fuel Island Man……32.25
Oil Tanker……32.25

Oil Tanker with Pup…….…….32.25
Foreman……..……...32.25

TRUCK DRIVER
Includes but is not limited to:
Driving a tractor trailer combination or a truck to transport goods or materials at the site of a public work or between sites of a public work. (Also, see descriptions listed with Truck Driver rates, if any.)

Craft: WELL DRILLER (Non-Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Well Driller……..…….60.78

JOB DESCRIPTION

1. Setting, operating or tending to portable drilling rig machinery and related equipment to drill wells;
2. Extending stabilizing jackscrews to support and level a drilling rig;
3. Installing water well pumps;
4. Drillings wells for industrial water supplies, irrigation water supplies or water supplies for any other purpose; dewatering or other similar purposes; exploration; hole drilling for geologic and hydrologic information; and core drilling for geologic information.

GROUP CLASSIFICATIONS

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
- Guideposts and Highway Signs
- Guardrail Erection and Dismantling
- Limber, Brushloader and Piler
- Pavement Marking and Highway Striping
- Traffic Barrier Erector
- Tending to portable space heaters
- Profilograph work all types manual, self propelled or carts
- Gabion basket, building, handling, installation and rigging
- Dry set paver work
- Traffic Barrier Erector

Group 2

- Choker setter or Rigger (clearing work only) Pittsburgh
- Chipper and similar type brush shredders
- Concrete worker (wet or dry) all concrete work not listed in Group 3 included but not limited to: concrete forms stripping, handling, cleaning, oiling and moving to the next point of installation.
- 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
- Semi-Skilled Wrecker (salvaging of building materials other than those listed in Group 3)
- Waterproofing work
- Epoxy 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
- Placement /anchoring of all earth stabilization/filters fabrics,
- Mechanically stabilized Earth (MSE) and Keystone type retaining walls rigging, placing , aligning, backfilling and installation of dead men and any stablilization compenents

Group 3

- Asphalt Workers (Ironers, Shovelers, Cutting Machine)
- Buggymobile
- Chainsaw, Faller, Logloader and Bucker

- Compactor (all types)
- Concrete Mixer under 1/2 yard
- Concrete Pan Work (Breadpan type), handling, cleaning\stripping
- Concrete Saw, Chipping, Grinding, Sanding, Vibrator
- 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
- Fence erector including safety, chain link, turtle, field and barbe wire fencing
- Form Raiser, Slip Forms
- Grouting of Concrete Walls, Windows and Door Jams
- Headerboardmen
- Jackhammer, Pavement Breaker, Air Spade
- Mastic Worker (wet or dry)
- Pipewrapper, Kettlemen, Potmen, and men 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
- 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 t any torch work cutting, burning, plasma are, 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 and underpinning pits, removal of debris with tuggers or 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 us 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, c

Group 4A

- Foreman

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

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.

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

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OPERATING ENGINEER, includes but is not limited to:

Group 1
- Engineer Assistant

Group 1A
- Oiler (Construction)
- Partsman

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 20)
- 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
- 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
- Instrument Man
- Kolman Loader
- 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
- 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
- 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)
- Finish Blade
- 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 -PILEDRIVER

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

STATE OF NEVADA

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Labor Commissioner

DEPARTMENT OF BUSINESS AND INDUSTRY
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2023-2024 Prevailing Wage

Amendment 1

- **AMENDMENT 1 – CLERICAL**
- **Classifications: Bricklayer Journeyman**
- **County – Washoe County Region**
- **Effective – December 27, 2023**

The following represents the amended wage rates

Craft: BRICKLAYER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Bricklayer Journeyman……53.43
Bricklayer Foreman……52.96

ADD ZONE PAY in addition to BRICKLAYER rates add the applicable amounts per hour, calculated based on road miles of over thirty-five (35) miles from the Washoe County Courthouse in Reno, Nevada:

Zone 1	0 to 35 miles	$0.00
Zone 2	35 to 75 miles	$2.50
Zone 3	Over 75 miles	$8.12

ADD PREMIUM PAY
One and one half (1 ½) the regular straight time hourly rate shall be paid:
1. For all hours worked over eight (8) hours in one day or shift.
2. For any hours worked on Saturday from midnight to midnight.

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over twelve (12) hours in one day or shift.
2. For any hours worked on Sunday from midnight to midnight.
3. For any hours worked on holidays from midnight to midnight.

RECOGNIZED HOLIDAYS

If any of these holidays fall on Sunday, the Monday following shall be considered a Holiday. New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Admission Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day.

JOB DESCRIPTION: Excerpt from Agreement between No, NV Masonry Contractors and LIUNA Local 169

This shall apply to and cover the work of Brick/Block Masonry, Stone Masonry, Artificial Masonry Marble Masonry.

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2023-2024 Prevailing Wage

Amendment 2

- **AMENDMENT 2**
- **Classification – Ironworker**
- **County – All Regions**
- **Effective – January 1, 2024**

The following represents the amended wage rates and recognized holidays

Prevailing wage rates include the base rate as well as all applicable fringes

Ironworker-Journeyman……82.86
Ironworker -Foreman……...87.61
Ironworker-General Foreman……92.82

ADD ZONE RATE
In addition to Iron Worker rates add the applicable amounts per day, calculated based on a road mile from the Reno City Hall or Las Vegas City Hall.

Zone 1	60 – 75 miles	$20.00
Zone 2	75 - 100 miles	$25.00
Zone 3	100 miles and over	$75.00

ADD PREMIUM PAY
One and one half (1X) the regular straight time hourly rate shall be paid:
1. For the first two (2) hours worked in excess of eight (8) on a regular workday Monday-Friday
2. For the first eight (8) hours on Saturday

Double the regular straight time hourly rate shall be paid for all time:
1. For all hours worked over ten (10) hours in one day or shift
2. For any hours worked on Sunday
3. For all hours worked over eight (8) on Saturday
4. For all hours worked on Holidays

Shift Pay
1. 2nd shift add 6% of hourly wage
2. 3rd shift add 13% of hourly wage
3. Dedicated shift add 6% of hourly wage

RECOGNIZED HOLIDAYS

New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Admission (Nevada) Day, Veterans Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Day

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2023-2024 Prevailing Wage

Amendment 3

- **AMENDMENT 3**
- **Classifications –**

  Lubrication and Service Engineer

  Operating Engineer

  Operating Engineer – Steel Fabricator & Erector

  Operating Engineer – Piledriver

  Surveyor
- **County – Washoe County Region and Northern Nevada Rural Region**
- **Effective – January 1, 2024**

The following represents the amended wage rates.

Craft: LUBRICATION AND SERVICE ENGINEER (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)……71.93

Add Operating Engineers Zone Pay
Add Premium Pay

Carson City: 1818 E. College Parkway, Suite 102 Carson City, Nevada 89706 - Telephone (775) 684-1890 - Fax (775) 687-6409

Las Vegas: 3340 West Sahara Avenue, Las Vegas, Nevada 89102 - Telephone (702) 486-2650 - Fax (702) 486-2660
www.labor.nv.gov

2023-2024 Prevailing Wage

Amendment 3

Craft: OPERATING ENGINEER (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Operating Engineers	(SEE GROUP CLASSIFICATIONS)
Group 1	66.91
Group 1A	69.67
Group 2	70.20
Group 3	70.47
Group 4	71.21
Group 5	71.51
Group 6	71.68
Group 7	71.93
Group 8	72.52
Group 9	72.84
Group 10	73.19
Group 10A	73.38
Group 11	73.62
Group 11A	75.26
Group 11B	76.07
Foreman	75.26

Add 12.5% to base rate for “Special” 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

Operating Engineers	(SEE GROUP CLASSIFICATIONS)
Group 1	82.21
Group 1 Truck Crane Oiler	76.04
Group 1 Oiler	74.08
Group 2	80.70
Group 2 Truck Crane Oiler	75.79
Group 2 Oiler	73.87
Group 3	79.46
Group 3 Truck Crane Oiler	75.57
Group 3 Oiler	73.65
Group 3 Hydraulic	75.24
Group 4	77.73
Group 5	76.63

Add 12.5% to base rate for “Special” Shift

Add Operating Engineers Zone Pay
Add Premium Pay

2023-2024 Prevailing Wage

Amendment 3

Craft: OPERATING ENGINEER (Union Rate)
PILEDRIVER

Prevailing wage rates include the base rate as well as all applicable fringes

Operating Engineers (SEE GROUP CLASSIFICATIONS)
Group 1……81.68
Group 1 Truck Crane Oiler……76.22
Group 1 Oiler……74.30
Group 2……80.14
Group 2 Truck Crane Oiler……76.01
Group 2 Oiler……74.10
Group 3……78.69
Group 3 Truck Crane Oiler……75.79
Group 3 Oiler……73.87
Group 4……77.18
Group 5……76.07
Group 6……72.79
Group 7……74.00
Group 8……73.04
Add 12.5% to base rate for “Special” Shift……

ADD ZONE RATE
In addition to: **OPERATING ENGINEER, STEEL FABRICATOR & ERECTOR, and OPERATING ENGINEER PILEDRIVER,** rates add the applicable amounts per hour calculated based on a road miles from the Carson City Courthouse or Washoe County Courthouse

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$5.00
Zone 3	150 to 300 miles	$6.00
Zone 4	300 miles over	$7.00

ADD PREMIUM PAY
1. One and one-half (1-1/2) times the applicable straight-time rate for the day, shift, work, equipment and classification shall be paid for all work (including repair work and field survey 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 time shall be paid.

2. Overtime. The following rates shall apply on Sundays and holidays and all work before a shift begins and after it ends:

RECOGNIZED HOLIDAYS
Holidays. Double the applicable straight-time rate shall be paid for all work (including repair, maintenance and field survey work) performed on Sundays and the following holidays: New Year's Day (January 1); Memorial Day (last Monday in May); Independence Day (July 4); Labor Day (1st Monday in September); Nevada Admission Day (last Friday in October); Thanksgiving Day (4th Thursday in November); the day after Thanksgiving Day; and Christmas Day (December 25). Holidays falling on

2023-2024 Prevailing Wage

Amendment 3

Sunday shall be observed on the following Monday. Holiday hours shall be reckoned on the same basis as Sunday hours.

Saturday Shift Period. On any shift, Saturday shall be the twenty-four-hour period commencing at 12:00 midnight Friday.

Sunday Shift Period. On any shift, Sunday shall be the twenty-four-hour period commencing at 12:00 midnight Saturday.

3. For hours worked in excess of 12) on any such workday, an Employee shall be paid two (2) times the regular straight-time rate of pay for each hour so worked.

JOB DESCRIPTION, 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.

Craft: SURVEYOR (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes.

..

Rodman/Chainman ……..……..69.97
Instrumentman……..……..71.43
Chief of Party Surveyor……..……..72.69

ADD ZONE RATE
In addition to: **OPERATING ENGINEER, STEEL FABRICATOR & ERECTOR, and OPERATING ENGINEER PILEDRIVER,** rates add the applicable amounts per hour calculated based on a road mile from the Carson City Courthouse or Washoe County Courthouse

Zone 1	0 to 75 miles	$0.00
Zone 2	75 to 150 miles	$5.00
Zone 3	150 to 300 miles	$6.00
Zone 4	300 miles over	$7.00

ADD PREMIUM PAY
1. One and one-half (1-1/2) times the applicable straight-time rate for the day, shift, work, equipment and classification shall be paid for all work (including repair work and field survey 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 time shall be paid.
2. Overtime. The following rates shall apply on Sundays and holidays and all work before a shift begins and after it ends:
Saturday Shift Period. On any shift, Saturday shall be the twenty-four-hour period commencing at 12:00 midnight Friday.
Sunday Shift Period. On any shift, Sunday shall be the twenty-four-hour period commencing at 12:00 midnight Saturday.

2023-2024 Prevailing Wage

Amendment 3

3. For hours worked in excess of 12 on any such workday, an Employee shall be paid two (2) times the regular straight-time rate of pay for each hour so worked.

RECOGNIZED HOLIDAYS: Holidays. Double the applicable straight-time rate shall be paid for all work (including repair, maintenance and field survey work) performed on Sundays and the following holidays: New Year's Day (January 1); Memorial Day (last Monday in May); Independence Day (July 4); Labor Day (1st Monday in September); Nevada Admission Day (last Friday in October); Thanksgiving Day (4th Thursday in November); the day after Thanksgiving Day; and Christmas Day (December 25). Holidays falling on Sunday shall be observed on the following Monday. Holiday hours shall be reckoned on the same basis as Sunday hours.

JOB DESCRIPTION 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.

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2023-2024 Prevailing Wage

Amendment 9

- **AMENDMENT**
- **Classification: Laborer Group 5A and Group 5A Foreman Only**
- **Region: Washoe County Region and Northern Nevada Rural Region**
- **Effective: August 15, 2024**

The following represents the amended wage rates

Craft: Laborer (Union Rate)

Prevailing wage rates include the base rate as well as all applicable fringes

Group 5A……51.28
Group 5A Foreman…….. 51.78

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. Disks are to have the Contractor's name, school name, project number, schedule file name, and data date on the disk label. 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:

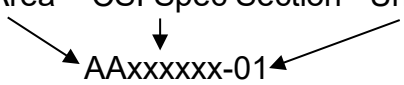
    a. Milestones
    b. Level of Effort Summary
    c. Prepare and Transmit Submittals

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 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 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.

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 trainings.

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.

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. Use other colors to distinguish between variations in separate categories of the 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. Bind sets with durable paper cover sheets; print suitable titles, dates and other identification on the cover of each set.

5. Provide record drawings using electronic media, 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

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

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED WORK

A. All other sections in Division 21, 22, and 23.

B. Specification Section 220800 – “General Commissioning Requirements”

C. Specification Section 260800 – “Electrical Systems Commissioning

D. Specification Section 230800 – “Mechanical Systems Commissioning”

1.2 RELATED DOCUMENTS

A. Owners Project Requirements (OPR)

B. Basis of Design (BOD)

1.3 COMMISSIONING AGENT OF RECORD

A. Company: The Commissioning Agent contracted directly with Washoe County School District will be McKinstry. The contractors or any of their sub-contractors are not responsible to hire the commissioning agent for this project.

B. Project Manager: The Project Manager is to be To Be Determined.

1.4 DESCRIPTION

A. The purpose of the commissioning process is to provide the Owner/operator of the facility with a high level of assurance that the mechanical, Plumbing and associated electrical Systems have been installed in the prescribed manner, and operate within the performance guidelines set in the design intent. The Commissioning Authority shall provide the Owner with an unbiased, objective view of the systems installation, operation, and performance. This process is not to take away or reduce the responsibility of the design professionals or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems to beneficial use by the owner. The Commissioning Authority will be a member of the construction team, cooperating and coordinating all commissioning activities with the design professionals, construction manager, contractors, subcontractors, manufacturers and equipment suppliers.

1.5 SCOPE

A. The General systems commissioning shall include a demonstration by the Contractor with the assistance of the Commissioning Authority (CxA) of each piece of equipment to comply with the Construction Documents (CD). The commissioning

process shall demonstrate that each piece of equipment is performing and operating to the CDs.

B. Participants in General Systems Commissioning: Commissioning systems shall be conducted with representatives from the following entities as needed.

1. General Contractor
2. Mechanical Contractor
3. BMS or ATC Contractor
4. Factory Authorized Service Personnel for all major pieces of equipment. This is not a sales representative but an authorized technician certified to work on the piece of equipment.
5. Water Treatment Contractor
6. Electrical Contractor
7. Test and Balance Contractor
8. Owner's Representative
9. Electrical Engineer
10. Mechanical Engineer
11. Architectural Team

C. Kickoff, Coordination and MEP Meetings

1. The CxA will attend the contractors sub meeting. Contractor shall schedule time at meetings for review of Issues log, upcoming installations, schedule, submittals, and commissioning plan review.
2. Other meetings such as the Commissioning Kick-Off Meeting, Update Meetings, and other Coordination Meetings shall be attended by those participants as indicated in the "Participants in General Systems Commissioning"

D. Submittal Reviews and Meetings

1. The CxA shall review each submittal in Division 22, 23, 26, and provide comment and review to the design team prior to return of submittal to contractor.

2. Submittal reviews are NOT an approval but a courtesy review to help validate products submitted is in general compliance with the construction documents.

E. Issues Log

1. An issues log shall be kept by the CxA. These issues will identify issues, defects, improper installations, and deficiencies of the installation and design. The issues log will have the issue, a potential resolution, the sub-contractor responsible, the date of the issue found and the CxA who found the issue.

2. The issues log shall be addressed weekly by the contractor; any unresolved items shall be included in the contractor punch list for completion.

3. When an item is completed and addressed by the contractor or sub-contractor responsible, the party responsible shall sign off and deliver to the CxA for review. The sign off shall include how the contractor addressed the issue and the date in which the contractor addressed the issue

F. Construction Checklist, Pre and Final Functional Testing Checklist, and Startup Checklist

1. The CxA shall develop construction checklist that will be executed by the CxA. The contractors and sub-contractors shall review the checklist for compliance with the ability of their individual systems. If the contractor or sub-contractors do not provide comments to the CxA then the CxA shall assume their procedures shall not harm nor deteriorate the individual systems. If a problem occurs during testing that causes a piece of equipment of system to malfunction, damage, or any other failure and the contractor or sub-contractor has not in writing opposed such test then the contractor or sub-contractor shall be liable for any damages and delays.

2. The contractor shall fill out checklist called Contractor Readiness checklist. These shall be delivered in the commissioning plan and shall be used to show the CxA that the contractor is ready for Final Function Testing.

3. Startup Sheets shall be delivered to the CxA. The contractor responsible for the piece of equipment is also responsible for delivering those startup sheets to the CxA.

4. Functional Testing shall be attended by the members as defined in “Participants in General Systems Commissioning.”

5. Should any of the aforementioned requirements not be met on the date that the commissioning process commences and or if deficiencies are observed during

the commissioning process the commissioning will be considered a failure and the deficiencies will be required to be remedied and then addressed in writing prior to requesting a date for re-commissioning. There will be no additional costs allowed to the Contractor for re-commissioning sessions as may be required to address issues that are found to be in non-compliance with the requirements of this specification.

G. Current Facility Requirements Document

1. The CxA shall prepare a document that contains the following pieces of information. This document shall include the following:

   a. a sequence of operations for the building
   b. the building occupancy schedule
   c. equipment run-time schedules
   d. set points for all General equipment
   e. set lighting levels throughout the building
   f. minimum outside air requirements
   g. any changes in schedules or set points for different seasons, days of the week, and times of day
   h. a systems narrative describing the mechanical systems and equipment
   i. a preventative maintenance plan for building equipment described in the systems narrative

2. The document shall be delivered to the Owner by the CxA in a Microsoft Word (.doc or .docx) format (Document for WCSD at end of project that UNVC will deliver.)

H. Systems Manual

1. The CxA shall prepare a document that contains the following pieces of information. This document shall include the following:

   a. As-built sequence of operation
   b. Original set points for all systems commissioned
   c. Recommended schedule for sensor recalibration
   d. Equipment operations and maintenance manuals
   e. Equipment preventive maintenance schedules
   f. Confirmation of completed training for the owner and occupants (Document for WCSD at end of project that UNVC will deliver.)

1.6 SYSTEMS TO BE COMMISSIONED

A. This list is not intended to be exhaustive. All division 22, 23, and 26 and any equipment, piping, balancing, controls, etc. that are defined in the entire cumulative sections of division 22, 23, and 26 will go through commissioning. The below list is a representative sample of items that are typically commissioned.

1. All electrical systems including power (emergency and normal), lighting controls, fire alarm, security, and audio/visual.

2. All building HVAC systems and controls

3. All building plumbing systems

1.7 COORDINATION

A. The Commissioning authority shall receive a copy of all construction documents, addenda, change orders, and appropriate approved submittals and shop drawings directly from the Contractor. We only use this documentation for our review, but not as a method of approval.

B. The Commissioning Authority shall disseminate written information and documents to all responsible parties relative to the nature and extent of the communication.

C. The Commissioning Authority is primarily responsible to the Owner, and as such, shall regularly appraise the Architect, the Contractor, and the Owner of progress, pending problems and/or disputes, and shall provide regular status reports on progress with each system. Any potential change in the contractual and/or financial obligations of the owner (credits, change orders, schedule changes, etc.) shall be identified and quantified as soon as possible.

D. The Commissioning Authority shall coordinate the schedule of commissioning activities with the construction schedule. It is possible that some procedures will be completed before the entire Mechanical system is completed.

1.8 SCHEDULE

A. Final Commissioning shall not commence on the individual pieces of equipment, Test and Balance, Controls, and other mechanical systems until the Contractor Readiness Forms are delivered to the CxA.

B. Pre-Functional Commissioning shall commence during the progress of the project. Contractor Readiness checklist do not typically have to be filled out for the CxA to check out these systems. However, the contractor is responsible to inform and schedule the CxA to do Pre-Functional Checks.

C. Contractor schedules and scheduling is the responsibility of the Contractor. The Commissioning Authority shall provide commissioning scheduling information to the contractor for review and planning activities.

D. Individual dates are defined in the individual commissioning specifications for each spec section as defined in the other commissioning specifications.

1.9 MISCELLANEOUS CONTRACTOR RESPONSIBILITIES

A. Means and Methods: The contractor is solely responsible for the means and methods of construction. While the CxA shall assist in construction the final responsibility rest solely on the General and Installation Contractor.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 COMMISSIONING KICKOFF MEETING

A. The CxA shall facilitate a Commissioning Kickoff Meeting after all Mechanical, Electrical, and General subcontractors are under contract with the General Contractor. The CxA shall invite the Architect, Engineers, and Owners Representatives to the meeting.

B. The General Contractor shall ensure that the following individuals are in attendance:

1. The Mechanical Foreman and Project Manager
2. The General Foreman and Project Manager
3. The Controls Foreman and Project Manager
4. The Test and Balance Project Manager
5. The Electrical Foreman and Project Manager
6. The Fire Protection Foreman and Project Manager
7. The General Contractor Project Engineer, Superintendent, and Project Manager

C. The CxA shall keep meeting minutes and distribute to the individuals present.

3.2 DISTRIBUTION LIST

A. The distribution list shall be developed during the Commissioning Kickoff Meeting. This distribution list shall be used for all distribution of commissioning activities. While every effort shall be made to distribute all pertinent information to the sub contractors by the CxA, the sole responsibility for sub-contractors to receive information rest on the General Contractor.

3.3 COMMISSIONING PLAN

A. The Commissioning Plan shall be developed by the CxA and delivered at the conclusion of the submittal process.

B. The Commissioning Plan will have the CxA Procedural Standards for testing, the PFAT checklist, the FAT checklist and the Contractor Readiness checklist.

C. The sub-contractors and contractors are responsible for reviewing the above checklist and provide comments to the CxA within 30 calendar days of receiving the commissioning plan. During this comment period, the comments must be received in writing and the CxA will work with the individual contractors and sub-contractors to ensure the safety of systems. After the thirty (30) day period for comment any additional comments received shall be reviewed by the CxA, however; the subcontractor shall be liable for any cost associated with this review and any delays.

3.4 SUBMITTAL REVIEWS AND SUBMITTAL MEETINGS

A. The CxA shall review all mechanical submittals. It is the responsibility of the Architect to ensure the contractor receives the CxA reviews. The Architect is responsible for delivering the submittals to the CxA, and to receive and incorporate comments prior to submittal return to contractor.

B. The subcontractor, supplier and manufacturer are responsible to submit with initial submittals a line by line submittal compliance document. The compliance document will follow the specification that the submittal is in reference too. The compliance document will have one of the following for each paragraph of the specification: Comply, Exception, or Unable to Comply. With each Exception and Unable to comply, the compliance document will have a detailed explanation.

3.5 BUILDING INFORMATION MODELING (BIM) REVIEWS

A. The CxA shall review the BIM models at 90% completion for access issues. The file shall be delivered to the CxA in a NavisWorks format (.nwd).

B. The contractor may split the review up by floors or buildings. Partial models shall not be reviewed by the CxA until the entire floor is completed to 90%.

C. The CxA shall deliver a floor plan with markups on areas of access concern.

D. BIM Model shall include the following:

1. All duct work and air handling equipment. Ductwork shall show flanges. Model shall show insulation around duct work.
2. All mechanical equipment.
3. All hangers including unistrut, clevis, all-thread and strap material.
4. Duct fittings including HETO and flex and diffusers/grilles.
5. Electrical work and controls conduit cumulating 1.5” or larger.
6. Mechanical access zones
7. Fire/Smoke or fire dampers including access zones.
8. Mechanical piping larger than ¾”.
9. Refrigerant lines, no matter the size.
10. Cable tray
11. Electrical Equipment
12. All hangers and supports for electrical equipment.
13. All light fixtures
14. All power feeds including conduit or bus bars.
15. Outlets and switches where location is a priority for architectural.
16. Electrical equipment access zones.
17. All occupancy sensors, daylight sensors, exit signs, fire alarm strobes and horns, cameras, speakers, and AV equipment located in ceiling grid.
18. Natural gas lines larger than ½”
19. Plumbing lines larger than ½”
20. Insulation shall be shown with the correct sizing on plumbing lines.

21. All plumbing valves and cleanouts.

22. Access zones to plumbing valves and cleanouts.

23. Fire protection piping no matter the size.

24. Fire protection drops

25. Fire protection equipment

26. The entire steel structure including beams, columns, supports, braces, bent plate, supports or secondary supports.

27. All catwalks and their support systems.

28. All concrete structures include walls, columns or beams.

29. All access doors in the architectural ceiling for access to all electrical, plumbing and mechanical systems.

30. Ceiling grid

31. All walls windows and doors.

32. Lab hoods

33. Soda Machine Lines
34. Kitchen equipment and hoods

3.6 COORDINATION MEETINGS (MEP MEETINGS)

A. The CxA will attend the contractors MEP meeting at a minimum every other week.

B. The purpose of these meetings for UNVC to attend is to assist with coordination of installation, commissioning, and testing activities. These meetings will be conducted by the contractor.

3.7 CONSTRUCTION OBSERVATION AND FIRST INSTALLS

A. The CxA shall observe construction activities throughout the construction of the project. The contractors shall be available during these observations for information as needed. An issues log as outlined in Part 1 shall be kept by the CxA.

B. Mockups or first installations of individual pieces of equipment need to be installed in their location where applicable. First Installs will be required of the contractor and sub-contractor as defined in the individual commissioning specifications.

C. Contractor shall coordinate and not prohibit observations and first installs. Sub-contractors, owner's representatives and engineers shall review the first installs for compliance.

3.8 CONTRACTOR READINESS CHECKLIST

A. Contractor Readiness Checklist (CRC) shall be delivered by the CxA to the contracting team for the contracting team to fill out. The purpose of the CRCs to inform the CxA of the readiness of the contractor to begin Functional Testing on the mechanical system.

B. The CxA shall not begin Functional Testing of the system or any equipment until the CRC are received. While some systems can be tested without a complete system the CxA shall have the final say on which can and cannot begin functional testing based on the completeness of the project. A single CRC can be completed per type of equipment. (i.e. if there are 80 Heat Pumps and all of them are ready then a single sheet can be filled out for all 80 Heat Pumps)

C. If the contractor delivers the CRC and the CxA finds, the system is not functional then the contractor shall be liable for cost incurred by the CxA.

3.9 PRE FUNCTIONAL CHECKLIST

A. The Pre Functional Checklist shall be developed by the CxA and delivered in the commissioning plan.

B. The Pre Functional Checklist shall be reviewed by the contractors and subcontractors and shall be executed by the CxA.

C. The CxA shall review 100% of all General systems installations.

3.10 FUNCTIONAL PERFORMANCE CHECKLIST

A. The CxA shall execute Functional Performance Checks. Suppliers, BMS or ATC Contractor, Mechanical Contractors, Electrical Contractors, Test and Balance Contractor, and General Contractors shall be available at the request of the CxA.

B. Commissioning Authority shall develop and document the commissioning procedures to be used this will be delivered to the contractor in the

commissioning plan and is called the Procedural Standards. Include a performance checklist and performance test data sheets for each system based on actual system configuration. These procedures shall be reviewed by the appropriate contractors and sub-contractors for technical depth, clarity of documentation and completeness. Emphasis shall be placed on testing procedures that shall determine actual system performance and compliance with the design intent.

C. The Commissioning Authority shall determine the acceptance procedures for each system within General divisions as required. The acceptance procedures shall incorporate the commissioning standards and successful testing results as referred to throughout General specifications.

D. The appropriate contractor and vendor(s) shall be informed of what tests are to be performed and the expected results. Whereas some test results and interpretations may not become evident until the actual tests are performed, all parties shall have a reasonable understanding of the requirements. The Commissioning Plan shall address those requirements and be distributed to all parties involved with that particular system.

E. Acceptance procedures shall confirm the performance of systems to the extent of the design intent. When a system is accepted, the Owner shall be assured that the system is complete, works as intended, is correctly documented, and operator training has been performed.

F. During the functional performance testing, the BMS or ATC contractor shall be in attendance to setup the CxA on the controls system and be in attendance throughout the Sequence of Operation checks.

G. The CxA shall review 100% and test 100% of all mechanical, electrical and plumbing systems.

3.11 TRENDING

A. Trending points will be outlined in the Procedural Standards as delivered by the CxA in the commissioning plan.

B. Following substantial completion and starting with normal building occupancy and use, a minimum Four (4) weeks of “Clean” trending (no mechanical, software, control loop or Building Management System “BMS” failures) shall be provided on “Any” or “All” BMS systems & points as directed by the CxA. Trends shall be coincident at 15 minute intervals with a cache able to handle four (4) weeks of trending on a rollover basis. The trending shall also be setup to a COV in conjunction with the 15 minute requirement if possible.

C. The CxA will review the trends after the four weeks of clean trending.

3.12 OPERATION AND MAINTENANCE MANUALS

A. The contractor responsible for Mechanical O&Ms shall deliver electronic copies of those O&M to the CxA at 75% billable completion of installed mechanical systems. The O&M manuals shall include installation requirements and maintenance requirements.

B. The final O&M Manual shall be reviewed by the CxA before delivery to the Owner. Any deficiencies shall be noted and the contractor shall remedy before final delivery.

C. The final O&M must be delivered to the Owner before training shall commence.

3.13 CURRENT FACILITY REQUIREMENTS AND OPERATION AND MAINTENANCE PLAN

A. The contractors shall support the CxA when they are gathering information for the following.

1. Sequences of operation for the building
2. Building occupancy schedule
3. Equipment run-time schedules
4. Set points for all General equipment
5. Lighting levels throughout the building
6. Minimum outside air requirements
7. Changes in schedules or set points for different seasons, days of the week, and times of day
8. Systems narrative describing the mechanical and electrical systems and equipment
9. Preventive maintenance plan for building equipment described in the systems narrative

10. CxA program that includes periodic CxA requirements, ongoing CxA tasks, and continuous tasks for critical facilities (UNVC will make this document, but it requires the contractor to aid in getting us any information as needed)

3.14 SYSTEMS MANUAL

A. The contractors shall provide the following in an editable Microsoft Word Format. (.doc or .docx) in a narrative format for use by the CxA to provide the final Systems Manual. The submittals shall be compiled by section in a .pdf format

1. Construction record documents and specifications
2. Approved submittals
3. As-built drawings
4. As-built sequence of operation
5. Equipment operations and maintenance manuals
6. Equipment preventive maintenance schedules
7. Confirmation of completed training for the owner and occupants

3.15 TRAINING

A. The CxA shall be invited to all General training sessions by the General Contractor.

B. The training shall not commence until the system has been commissioned and proven ready for training.

C. The contractor shall schedule and coordinate training sessions for the Owner's staff for each system. Training may be in a classroom setting with the appropriate schematics, handouts, and visual/audio training aids on-site with equipment.

D. The Commissioning Authority shall review agendas and training schedules, which shall be submitted four weeks before training**.**

E. The agenda shall include but not limited to operational set points, runtime schedules, general operation and maintenance requirements, time and location for the training.

F. The training program shall include the following:

1. Emergency instructions and procedures
2. Operation instructions and procedures
3. Troubleshooting procedures
4. Maintenance and inspection procedures
5. Repair procedures
6. Upkeep of the systems manual and associated maintenance documentation logs

G. Evaluations shall be done of the training system by the attendees. The evaluations shall reflect ASHRAE 0-2013-Appenix P Evaluation Form.

1. If the Evaluations from the training average rises above 2 (based on 1 being very well trained and 5 not at all trained) then the training shall recommence. All cost for the re-training shall be solely born by the contractor training. Including any reimbursement to the Owner for the CxA, the Owners Operational Staff, and any other cost born by the owner for failure to comply with requirements.

H. The contractor shall provide a schedule for training times and dates. The schedule shall include location, who is training, trainer's contact information,

I. The appropriate installing contractors shall provide training on all the major systems per specifications, including peculiarities specific to this project.

J. The equipment vendors shall provide training on the specifics of each major equipment item including philosophy, troubleshooting, and repair techniques.

K. The automatic control vendor shall provide training on the control system per their specification section.

L. The contractor shall furnish a final video DVD set, above the owner's requirements as defined elsewhere, to the CxA for their use and ownership and review. Included in those DVDs shall be the sign-in sheet for each training.

3.16 RECORD DRAWINGS OR REDLINES

A. The CxA shall review the "Redlines" or "Record Drawings" on a bi-weekly basis.

B. Record Drawings or Redlines shall be kept in a printed format beyond any BIM modeling. If record drawings are being kept on BIM a printed out version on a

typical 2D flat sheet of paper large enough to read shall be kept as well in the General Contractors trailer.

C. The following requirements shall be meet for Redlines or Record Drawings:

1. Underground: All underground piping no matter the size shall be shown with dimensions from walls (not gridlines) and elevations of the pipe at every ninety or y fitting and marked at every 20 feet on the drawings.

2. Above Ground Concealed: All above ground piping no matter the size concealed in hard lid or behind walls shall be dimensioned from walls.

3. Above Ground Accessible or Unconcealed: All above ground piping, no matter the size, shall be documented in the redlines. General location shall be sufficient as long as the general location is in the same area not separated by walls.

D. The final redlines shall be reviewed by the CxA before delivery to the Architect.

3.17 WARRANTY PERIOD AND CONTINUOUS COMMISSIONING

A. The CxA shall provide Continuous Commissioning during the One Year Warranty Period after substantial completion. During this time, the CxA shall adjust settings on the BMS for optimization of the system, shall find issues with the system, and shall report issues to the contractors.

B. The contractor and sub-contractors shall resolve issues immediately.

3.18 REPEATED WORK, TESTING, AND REVIEWS

A. Contractor shall, at no additional cost to the Owner, repeat the complete verification test procedure for each test for which acceptable results are not achieved. Repeat tests until acceptable results are achieved.

B. Contractor shall compensate the Owner for costs incurred as the result of tests review or inspection repeated. This includes the costs for the Commissioning Authority, Design Architect, Design Engineers, and Owner--s personnel for billed costs (including travel expenses) for the extraordinary participation of the Owners Representative, Architect, Commissioning Authority or owner’s staff.

END OF SECTION 01 91 13

Technical Specifications
VOLUME 1 Divisions 1 thru 14

Washoe County School District
Silver Dollar Elementary School

100% Construction Documents
August 12, 2024

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SECTION 00 00 01 – PROJECT DIRECTORY

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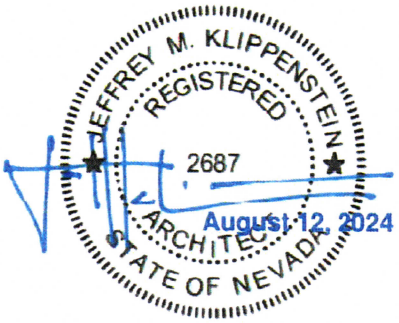

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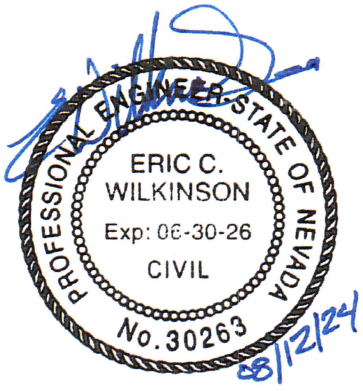

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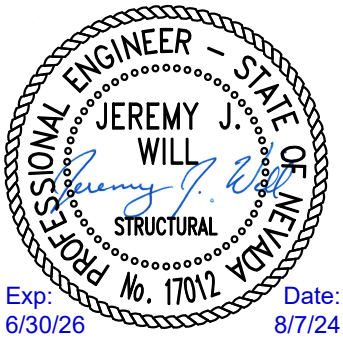

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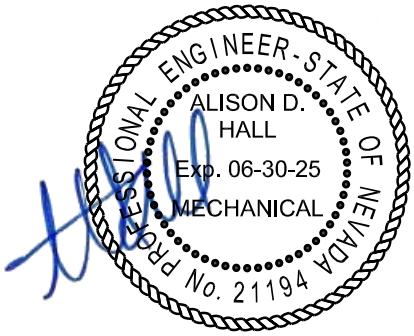

08/07/2024

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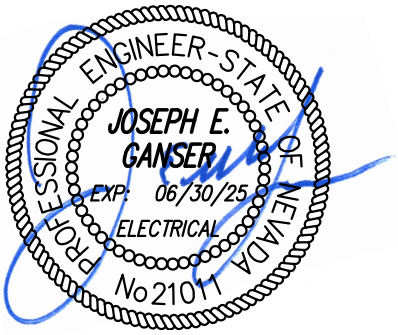

08/07/2024

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22 05 00 BASIC MATERIALS AND METHODS FOR PLUMBING
22 05 20 OPERATION AND MAINTENANCE OF PLUMBING SYSTEMS
22 05 30 HANGERS AND SUPPORTS FOR PLUMBING SYSTEMS
22 05 40 SEISMIC BRACING FOR PLUMBING SYSTEMS
22 07 00 PLUMBING INSULATION
22 08 00 TESTING, ADJUSTING, AND BALANCING OF PLUMBING SYSTEMS
22 08 10 PLUMBING SYSTEMS COMMISSIONING
22 08 20 THIRD PARTY COMMISSIONING OF PLUMBING SYSTEMS
22 09 00 PLUMBING FIXTURES AND TRIM
22 10 00 FACILITY WATER DISTRIBUTION

22 10 10 COPPER PIPING WITH PRESS FITTINGS
22 13 00 FACILITY SANITARY SEWERAGE
22 14 00 FACILITY STORM DRAINAGE
22 15 00 FACILITY NATURAL GAS SYSTEMS
22 23 00 HEAT TRACING FOR PLUMBING PIPING
22 34 00 GAS FIRED DOMESTIC WATER HEATERS

Division 23 Heating, Ventilating and Air Conditioning

23 00 00 HEATING, VENTILATING, AND AIR CONDITIONING
23 05 00 BASIC MATERIALS AND METHODS FOR HVAC
23 05 20 OPERATION AND MAINTENANCE OF HVAC SYSTEMS
23 05 30 HANGERS AND SUPPORTS FOR HVAC SYSTEMS
23 05 40 SEISMIC BRACING FOR HVAC SYSTEMS
23 07 00 HVAC INSULATION
23 08 00 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS
23 08 10 HVAC SYSTEMS COMMISSIONING
23 08 20 THIRD PARTY COMMISSIONING OF HVAC SYSTEMS
23 09 00 TEMPERATURE CONTROLS
23 09 10 SEQUENCE OF OPERATION
23 09 20 VARIABLE FREQUENCY DRIVES
23 21 00 HYDRONIC PIPING AND ACCESSORIES
23 21 10 COPPER PIPING WITH PRESS FITTINGS
23 21 80 SNOW AND ICE MELT PIPING AND ACCESSORIES
23 22 00 HYDRONIC PUMPS
23 25 00 CHEMICAL TREATMENT
23 31 00 HVAC DUCTWORK
23 31 10 HVAC DUCTWORK ACCESSORIES
23 34 00 HVAC FANS AND HOODS
23 37 00 AIR OUTLETS AND INLETS
23 75 00 WATER SOURCE HEAT PUMPS
23 81 00 OUTDOOR MAKE-UP AIR UNITS
23 89 00 ELECTRIC HEATERS
23 99 00 GROUND LOOP PIPING SYSTEM
23 99 10 GROUND LOOP PRESSURE AND LEAK TESTING
23 99 20 GROUND LOOP FLUSHING AND PURGING
23 99 99 GLOBAL POSITIONING UTILITY LOCATION INSTRUCTIONS

Division 26 Electrical

26 00 01 ELECTRICAL GENERAL PROVISIONS
26 00 02 ELECTRICAL SUBMITTALS
26 00 03 TEMPORARY ELECTRICAL FACILITIES FOR CONSTRUCTION
26 05 03 EQUIPMENT WIRING CONNECTIONS
26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 05 30 SEISMIC PROTECTION
26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 05 53 ELECTRICAL IDENTIFICATION
26 05 73.13 SHORT-CIRCUIT STUDIES
26 05 73.16 COORDINATION STUDIES
26 05 73.19 ARC-FLASH HAZARD ANALYSIS
26 08 10 ELECTRICAL SYSTEMS COMMISSIONING

26 09 23 LIGHTING CONTROL DEVICES
26 22 00 LOW-VOLTAGE TRANSFORMERS
26 24 13 SWITCHBOARDS
26 24 16 PANELBOARDS
26 27 16 ELECTRICAL CABINETS AND ENCLOSURES
26 27 26 WIRING DEVICES
26 28 13 FUSES
26 28 19 ENCLOSED SWITCHES
26 35 56 SURGE PROTECTIVE DEVICES
26 51 00 INTERIOR LIGHTING
26 56 00 EXTERIOR LIGHTING
26 60 00 ELECTRICAL SYSTEMS TESTING

Division 27 Communications

27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
27 05 28 INTERIOR COMMUNICATIONS PATHWAYS
27 05 43 EXTERIOR COMMUNICATIONS PATHWAYS
27 08 00 COMMISSIONING OF COMMUNICATIONS
27 11 00 COMMUNICATIONS EQUIPMENT ROOM FITTINGS
27 13 00 COMMUNICATIONS BACKBONE CABLING
27 15 00 COMMUNICATIONS HORIZONTAL CABLING
27 41 00 AUDIO VISUAL SYSTEMS
27 41 16 CLASSROOM AUDIO ENHANCEMENT AND SAFETY ALERT SYSTEM
27 51 13 PAGING SYSTEMS
27 51 29 EMERGENCY COMMUNICATION SYSTEMS
27 53 13 WIRELESS CLOCK SYSTEMS
27 53 19 EMERGENCY RESPONDER RADIO SYSTEM

Division 28 Electronic Safety and Security

28 00 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY
28 05 00 CONDUCTORS AND CABLE FOR ELECTRONIC SAFETY AND SECURITY
28 05 26 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY
28 05 28 CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY
28 05 53 IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY
28 10 00 ACCESS CONTROL
28 20 00 VIDEO SURVEILLANCE
28 30 00 SECURITY DETECTION, ALARM AND MONITORING
28 31 00 FIRE DETECTION AND ALARM

Division 31 Earthwork

31 10 00 SITE CLEARING
31 20 00 EARTH MOVING
31 22 01 STRUCTURAL EARTHWORK

Division 32 Exterior Improvements

32 11 23 AGGREGATE BASE COURSES
32 12 00 FLEXIBLE PAVING
32 13 00 RIGID PAVING

32 17 23 PAVEMENT MARKINGS
32 31 13 CHAIN LINK FENCES AND GATES
32 33 00 SITE FURNISHINGS
32 84 00 PLANTING IRRIGATION
32 93 00 PLANTS

Division 33 Utilities

33 11 00 WATER UTILITY DISTRIBUTION PIPING
33 31 00 SANITARY UTILITY SEWERAGE PIPING
33 41 00 STORM UTILITY DRAINAGE PIPING

END OF SECTION 00 00 10

SECTION 01 43 39 – CLASSROOM MOCKUP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Classroom Mockup

B. Related Documents:

1. Drawings and general provisions of the Subcontract apply to this Section.
2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

C. The Classroom Mockup shall include a typical Classroom, the associated Toilet Room, and the adjacent Mechanical Closet.

D. The mockup is intended to be completed as the project progresses. In other words, separate inspections will be made for items such as windowsills, casework, ceilings, mechanical units, etc., as construction sequencing allows. The contractor is advised not to proceed with the subject work in any of the 27 other classrooms until the subject work has been approved.

E. Where review of mock-ups may require revisions of designs or construction techniques, the Owner and/or Architect will provide such revisions in writing to Subcontractor.

1.3 DEFINITIONS

A. Mockups: Full-size physical assemblies that are constructed as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation conference: conduct conference at project site.

1. Meet with owner, construction manager, architect, and installers of major systems whose work is included in the classroom mockup.

2. Review coordination of equipment and furnishings provided by the owner for room mockups.

3. Review locations and extent of mockups.

4. Review testing procedures to be performed on mockups.

5. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups [and testing] and maintain schedule for the work.

1.5 ACTION SUBMITTALS

A Mockup Shop Drawings: For Classroom mockups.

1. Provide shop drawings as required in related specification sections for products and/or assemblies used in the mock-up.

1.5 INFORMATIONAL SUBMITTALS

A. Provide product information as required in related specification sections for products installed in the mock-up.

1.6 SCHEDULING

A. THE CONTRACTOR SHALL COORDINATE THE WORK OF THE MOCKUP WITH THE PROJECT SCHEDULE AND THE PRODUCT SUBMITTALS. THE WORK OF THE MOCKUP SHALL APPEAR AS A LINE ITEM ON THE PROJECT SCHEDULE, IN ORDER FOR WCSD PURCHASING TO ORDER OWNER-FURNISHED, CONTRACTOR-INSTALLED (OFCI) ITEMS IN DUE TIME.

1.7 QUALITY ASSURANCE

A. Classroom Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location indicated or, if not indicated, as directed by Architect, Owner, or Owner’s Representative.
2. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform the same tasks during the construction of the Project.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect’s and Owner’s approval of mockups before starting corresponding Work, fabrication, or construction.
   a. Allow seven days for initial review and each re-review of each mockup.
5. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
6. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

1.1. The Contractor shall select one Classroom area, within the building, of his choosing. to serve as the mock-up. The mockup shall include the adjacent toilet room and mechanical closet.

1.2 AT VARIOUS STAGES OF CONSTRUCTION, THE CONTRACTOR SHALL REQUEST A REVIEW OF INSTALLED COMPONENTS OF THE CLASSROOM ARE AS THEY BECOME READY. SUCH ITEMS MAY INCLUDE:

a. Window assemblies

b. Windowsills

c. Mechanical unit installation and plumbing.

d. Coordination with owner-supplied items and devices.

e. Resinous flooring & wainscot

f. Casework

g. Gypsum board texture

h. Painting

i. Carpeting

j. Markerboards and tackable wall surface

k. Suspended ceiling and light fixtures.

END OF SECTION 01 43 39

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 7-16, 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 7-16 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 7-16 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 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED WORK

A. Specification Section 22 08 10 (Plumbing Systems Commissioning)

B. Specification Section 23 08 10 (HVAC Systems Commissioning)

C. Specification Section 26 08 10 (Electrical Systems Commissioning)

D. All other Specification Sections in Divisions 22, 23, and 26.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Owner's Project Requirements and Basis of Design documentation are included by reference for information only.

C. ASHRAE Guideline 0-2005, The Commissioning Process

D. Systems To Be Commissioned

1. This specification section is applicable to the following systems and equipment to be commissioned in this project:

   a. Mechanical systems, all HVAC systems, equipment, and controls including the BAS.

   b. Electrical service and distribution, emergency power, and electric metering.

   c. Lighting and lighting controls.

   d. Domestic hot water systems and controls.

   e. Plumbing domestic hot and cold-water systems, pumping, natural gas and water metering, and associated controls.

   f. Water recovery, recycle and re-use systems.

E. Systems Not Included

1. This specification section is not applicable to the following systems and equipment listed below. Commissioning of these systems may fall under the responsibility of the Contractor and/or the Authority Having Jurisdiction (AHJ) as noted in the specifications.:

a. Electrical branch circuit wiring and receptacles.

b. Renewable energy systems are not included in the scope of work as they are not included in the design.

c. Fire alarm and life safety system.

d. Fire protection, suppression, and sprinkler system.

e. Other Plumbing systems such as waste and storm water, industrial cold water, compressed air, and vacuum air.

f. Audio / visual and paging systems.

g. Security / access system including electronic interlocks.

h. Telecommunications / IT systems.

i. Data center equipment.

j. Process systems, equipment and tools.

k. Vertical transportation and elevator systems.

l. Other special systems.

1.3 DEFINITIONS

A. Basis of Design (BOD): The documentation of design criteria and assumptions for systems, components, and methods chosen to meet the Owner's Project Requirements and applicable regulatory requirements, standards, and guidelines. The document includes narrative descriptions of the systems to be commissioned. The BOD is prepared by the Design Professionals.

A. Building Automation System (BAS): The automated building system providing control and user interaction with select building systems, such as the HVAC, domestic hot water and lighting systems. Also, often referred to as building management system (BMS), energy management system (EMS), or an energy management and control system (EMCS).

B. Commissioning (Cx): A quality-focused process to verify and document that building systems are installed and perform as intended per the OPR, BOD and design documents.

C. Commissioning Authority (CxA): An independent entity hired directly by the Owner to lead, oversee and review the completion of the commissioning process and tasks. The CxA is not responsible for the design or construction of the project. The CxA is the authority on commissioning process, program elements and results, and assists the construction team with coordinating and completing tasks. And reviews and witnesses the completion of the process and tasks using a sampling approach.

D. Functional Performance Test (FPT): A test of the dynamic function, operation and control of the equipment and systems to verify system performance to the fullest extent. Systems are tested under various operating modes and control sequences including failure modes. The FPTs are performed using manual (direct observation) or monitoring methods. The FPTs can include sequence of operation tests, verification tests, performance tests, integrated systems tests, and trend analysis (monitoring). FPTs are often referred to as acceptance testing.

E. General Contractor (GC): The contractor directly contracted to the Owner with overall responsibility for the project construction and all commissioning activities described herein.

F. HVAC: Heating, ventilation, air conditioning.

G. Installation Verification (IV): Field verification and documentation of proper installation of system equipment, assemblies, and components, per design documents, manufacturer guidelines and industry standards. The IV process is typically complete when systems are ready for startup or operation.

H. Owner's Project Requirements (OPR): A document describing the operational and functional requirements of a project, the expectations of how the facility will be used and operated, and the equipment and system expectations and requirements, as defined by the Owner. This document provides an explanation of the ideas, concepts, goals, success criteria, and supporting information for the project.

I. Pre-Functional Check/Test (PFC): A check or test performed on a piece of equipment or system before, during, or after the initial startup and operation, but prior to the FPT phase. The PFC is performed to confirm, verify and document the system equipment and individual components are working properly, are controlled properly and meeting applicable performance requirements and specifications.

J. Startup: Initial starting or activating of equipment usually performed by the Trade Contractor or the Manufacturer's authorized representative, including applicable PFCs during the startup process.

K. Systems Manual: A manual that provides the operating staff the information needed to understand and optimally operate the commissioned systems. It expands upon the scope of traditional operating and maintenance documents and is compiled of multiple documents such as the final BOD, single line diagrams, and as-built controls drawings and sequences of operation.

L. TAB: Testing, Adjusting, and Balancing (TAB) work on the HVAC&R air and water systems to ensure design flow, pressure and temperature conditions are met. Performed by the TAB Trade Contractor.

M. Trade Contractor: A subcontractor who provides and installs specific building components and systems and/or provides certain services.

1.4 GENERAL COMMISSIONNG DESCRIPTION

A. Commissioning is a quality-focused process for achieving, verifying and documenting that building systems are installed and perform functionally as intended according to the OPR, BOD, and the requirements of the design documents.

B. The work includes the completion and documentation of formal commissioning procedures by the GC, Trade Contractors, and the Manufacturer Representatives.

1. The GC and Trade Contractors shall provide the quality control for the installation, startup, checkout and testing of the systems. The commissioning process provides independent review and witnessing by the CxA (using a sampling approach) throughout the process and during qualitative functional performance testing, to observe and verify the implementation of the process, specific tasks and quality control efforts.

2. The Trade Contractors and the Manufacturer Representatives shall be responsible for participation in the commissioning process as outlined in this specification and trade / system specific commissioning specifications.

C. Commissioning during the construction phase is intended to achieve the following specific objectives:

1. Commissioning review of the Trade Contractor submittals for major systems to be commissioned, concurrent with the Design Team's review.
2. Finalize the Cx Plan including project specific checklist, forms and procedures.
3. Verify the applicable equipment and systems are installed according to the design documents, manufacturer's recommendations and to industry-accepted minimum standards, and that they receive the required operational checkout and testing by the Trade Contractors.
4. Test, verify and document proper performance of equipment and systems through execution of pre-functional checks and functional performance tests.
5. Verify the Owner's facilities and operations personnel and building occupants are trained according to contract document requirements.
6. Issue the commissioning report and documentation.
7. Develop a Systems Manual, including the current facility requirements and an ongoing Cx plan, which provides the operating staff the information necessary to optimally operate the commissioned systems.

D. Commissioning during the post-occupancy, warranty phase is intended to achieve the following specific objectives:

1. Perform any necessary seasonal or deferred testing, to be defined in the Cx Plan.
2. Review the system operations and performance through monitoring based commissioning (MBCx). Details of the operation review are detailed in MBCx Plan. The CxA will report any identified issues and recommendations for system improvements from the trend analysis.
3. Review the system operations with the O&M staff, and any open or new Cx issues and recommendations with the commissioning team members, within 10 months of substantial completion (and no later than 2 months prior to the end of the warranty phase).

E. The commissioning process does not take away from or reduce the responsibility of the GC to provide a finished and fully functioning building. The GC has overall responsibility to assure that all systems are properly checked, tested and commissioned, and that all required commissioning documents are completed and provided to the CxA.

F. The Project will meet the requirements of the International Energy Conservation Code (IECC) 2018, Section C408, and the Commissioning Requirements of LEED v4.1 , Energy & Atmosphere Prerequisite - Fundamental Commissioning and Energy & Atmosphere Credit - Enhanced Commissioning: Option 1, Path 1 (Enhanced Commissioning).

1. The GC, Trade Contractors, and suppliers are responsible to ensure all requirements for such commissioning are met in their respective work.

1.5 COMMISSIONING TEAM

A. The Commissioning Team is responsible for performing the process and achieving successful commissioning results. The Commissioning Team is comprised of the following:

1. Owner's Representatives
2. Design Professionals.
3. Commissioning Authority (CxA).
4. General Contractor (GC).
5. Trade Contractors responsible for the systems to be commissioned.
6. Manufacturer Representatives supplying equipment, materials, components and controls for the systems to be commissioned.

1.6 GENERAL COMMISSIONING PROCESS

A. Unless otherwise noted in the system / division specific commissioning specification sections, the general commissioning process is as follows. See the system / division commissioning specification sections for additional details on the commissioning process.

B. Submittal Reviews by the CxA (concurrent with the Design Team reviews):

1. The GC shall include the CxA on the distribution of the Trade Contractor issued submittals to the Design Team, for the systems to be commissioned. The CxA will review pertinent submittals and provide review comments to the Design Team.

C. Cx Plan and Form/Procedure Development:

1. The CxA prepares a Cx Plan that provides guidance in the execution of the commissioning process during construction and if applicable the warranty phase.
2. The GC and Trade Contractors shall submit to the CxA, for review and approval, the procedures and "blank" forms for completing the various Cx pre-functional tasks including IV, Startup, and PFC tasks prior to conducting any of these tasks.

3. The CxA develops the FPT forms and provides them to the GC and Trade Contractors for review and comment.

D. Pre-Functional Tasks:

1. The Trade Contractors shall perform the IV, Startup and PFC tasks for all systems and equipment (no sampling allowed), unless the contract or design documents allow for sampling of pre-functional checks/tests (as an example, if sampling were allowed for pre-functional HVAC system duct leakage tests).
2. The Trade Contractors and the GC shall document completion of the IV, Startup and PFC tasks on the IV, Startup, PFC forms, and shall submit the completed IV, Startup, and PFC forms to the CxA in a manner or software program approved by the CxA.
3. The CxA will observe construction activities throughout the construction of the project. Schedule observations and coordinate with GNC. An issues log as outlined in Part 1 will be kept by the CxA.
4. Mockups or first installations of individual items of equipment that are representative of mulitiple installations shall be installed in the appropriate location for review by the CxA (if within scope) and the Engineer. The contractor shall coordinate observations of First Installs and shall not prohibit observations of First Installs. Subcontractors, Owner's Representatives, and Engineers shall review each of the First Installs for compliance prior to proceeding with subsequent installations of the same type.
5. The CxA will review the completed IV, Startup, and PFC forms. The CxA will also conduct various field observations and reviews of the installation including field reviews of the completed IV forms, and may witness a sample of the Startup and PFC activities. Some witnessing of the PFC activities may be performed as back-checks conducted by the Trade Contractor with the CxA, after PFC forms are complete.
6. The Trade Contractor shall resolve any IV, Startup and PFC results deemed unacceptable by the CxA. And the Trade Contractor shall perform the IV, Startup and PFC tasks and where applicable, execute a new sample of the PFCs to be witnessed by the CxA. The CxA shall deem the IV, Startup and PFCs acceptable after resolution of all issues and any witnessed sampling results in no issues.
7. The CxA may create System Readiness Checklists to track the status and completion of the IV, Startup, and PFC forms, including review by the CxA, prior to the FPTs.

E. Functional Performance Testing:

1. The Trade Contractors shall execute the FPTs, with the FPTs witnessed by the CxA unless stated otherwise by the CxA. The FPTs may be achieved by any combination of manual testing, monitoring or trend analysis.
2. The GC and Trade Contractors are responsible for ensuring all systems are installed, operating and performing per the requirements of the contract and design documents, and are ready for the FPTs.
3. The Trade Contractors shall determine what level of pre-testing is appropriate in order to prepare for the CxA witnessed FPTs.
4. A percent sampling approach may be used for executing the FPTs of identical systems and equipment. The approximate sampling rates are either defined in the respective system / division specific commissioning specifications and/or the Cx Plan, with additional details defined in the Cx Plan.
5. The acceptance criteria for the FPT sampling shall be zero, meaning, any FPTs that do not pass shall require the Trade Contractor to resolve the issue for all applicable systems and equipment (even those specifically not in the original sample) and new sample rates selected for a re-test executed by the Trade Contractor and witnessed by the CxA. The CxA shall deem the FPTs acceptable after all FPTs, including re-tests, have passed and resolution of all issues completed.
6. The CxA will document the results of all FPTs on the associated FPT forms created by the CxA, unless indicated otherwise on the FPTs.
7. The system / division specific commissioning specifications and/or the Cx Plan will define any required seasonal or deferred testing.

F. Commissioning Issues & Recommendations:

1. Throughout the process, the CxA records Cx issues and recommendations on the Cx Issues Log and distributes the log to the team. The GC and Trade Contractors shall provide updates to the Cx Issues Log and correct Cx issues and retest the system(s) without delay at no additional cost to the Owner.
2. The software program and format for the Cx Issues Log will be provided by the CxA or another software program and format may be used as approved by the CxA.
3. The CxA will verify the completion of the issues and recommendations via onsite reviews or witnessed retests, documentation or photographs provided by the GC and Trade Contractors, or based on information and communications provided by the GC and Trade Contractors.

G. Training Verification and Final Documentation:

1. The GC shall submit a comprehensive Training Plan for review by the Design Team, CxA and Owner, prior to conducting any training.
2. The Training Plan shall meet the specific requirements in the contract documents and specifications for each applicable system to be commissioned and the LEED Enhanced Commissioning requirements, and may include both operations and maintenance (O&M) staff training and building occupant training.
3. The GC shall coordinate with the Owner and/or Owner's Representatives, as needed, regarding any specific requirements for occupant training.
4. The CxA will verify completion of the training by receiving a copy of all training class sign-in sheets and any training materials / handouts, to be provided by the GC or Trade Contractors. The CxA may also sample witness some of the training sessions.
5. The GC will confirm all O&M manuals have been issued to the owner per contract documents. If needed, the CxA will ask for copies of the O&M manual submittals.
6. The CxA will complete the Commissioning Report and all associated documentation for the Owner with assistance from the GC and Trade Contractors.
7. The CxA will develop the Systems Manual (per the LEED requirements), including the current facility requirements and an ongoing Cx plan, with assistance from the GC and Trade Contractors.

H. Post-Occupancy Warranty Phase Commissioning:

1. The CxA will report any identified operational or performance issues (identified by the building O&M staff or warranty phase Cx activities) to the GC via a Warranty Phase Cx Issues Log for resolution by the GC and Trade Contractors during or prior to the end of the warranty period.
2. The Trade Contractors shall execute any defined seasonal or deferred FPTs, witnessed by the CxA.
3. The CxA may conduct onsite visits to review system operation and performance with the Owner's O&M team and/or may review system trend data during the Warranty Phase and will report any identified issues and recommendations from the trend analysis.
4. No later either 10 months after substation completion or two months prior to the expiration of the first 12-month warranty period of building occupancy, the CxA will return to the facility to interview facility O&M staff, walk the facility and review systems operation and trend data where applicable. Key representatives from the GC and Trade Contractors shall attend a site walk-through and meeting, as determined by the CxA.

1.7 COMMISSIONING RESPONSIBILITIES

I. General:

1. The Commissioning Team and all others involved in the commissioning process shall follow the Cx Plan, attend the commissioning kickoff meeting, and attend additional commissioning meetings as necessary.

J. Commissioning Authority (CxA)

1. The primary role of the CxA is to oversee, organize and lead the commissioning team and assist the GC and Trade Contractors in executing the commissioning process.
2. Prepare the Cx Plan and develop the FPT forms.
3. Work with the GC to schedule commissioning activities.
4. Lead commissioning team meetings, prepare meeting agendas and distribute meeting minutes.
5. Observe and witness on a sampling basis the system and equipment installation, start-up, checkout, and testing for compliance with the OPR, BOD, and design documents; and review completion of commissioning documentation. (or as indicated in scope)
6. Witness the execution of the FPTs by the Trade Contractors.
7. Be the authority on commissioning test results and other commissioning program elements completion.
8. Prepare, maintain and distribute the Cx Issues Log.
9. Review and comment on Training Plan and verify training is completed.
10. Lead the effort in developing the Systems Manual.
11. Assemble the commissioning documents and prepare the Commissioning Report.
12. The CxA is not responsible for:

a. Design, design concept or design criteria
b. Review for code compliance
c. Inspector of record services
d. Design and construction scheduling
e. Cost estimating
f. Construction management
g. Providing tools and test equipment used for commissioning.
h. Scheduling startup and testing
i. Coordinating the work of Trade Contractors and any special testing agents
j. Performing startup and testing

K. Owner's Responsibilities

1. Oversees the activities and deliverables of the CxA.
2. Assists in the facilitation of the commissioning process.
3. Include the CxA in pertinent communications and meetings, including meeting minutes, drawing updates, known issues, etc.
4. Review and provide feedback to CxA of the Cx plan, forms and test procedures.
5. Attend progress meetings to observe and provide direction on open issues.
6. Conduct periodic site visits; report any issues to CxA for documentation and follow-up.
7. Identify operations staff as early as possible and encourage their involvement in the commissioning process, including witnessing the FPTs.
8. Periodically include Operations staff in onsite inspections and reviews.
9. Witness/participate in the FPT at Owner's discretion.
10. Work with CxA, Design Team, and Contractors to resolve the Cx issues.
11. Ensure O&M staff is available for training.
12. Review the O&M Training Plan and Agendas.
13. Review the final Commissioning Report.

L. Design Team Responsibilities

1. Review and provide feedback to CxA of the Cx plan, forms and test procedures.
2. Participate in the resolution of Cx issues and recommendations identified during commissioning.
3. Review and comment any design-related questions or issues that arise during commissioning process.
4. The Mechanical Engineer shall review and approve TAB Reports.

M. General Contractor:

1. The GC is responsible for overseeing the execution of the commissioning process and ensuring that all Trade Contractors execute their commissioning tasks, quality control efforts and responsibilities according to the contract documents, Cx specifications, Cx Plan, and schedule.
2. Include the cost for commissioning in the project cost.
3. Schedule and coordinate the commissioning meetings with the CxA.
4. Plan, schedule, coordinate and facilitate the commissioning work performed by the Trade Contractors. Provide sufficient lead time of at least 10 days to notify the CxA in advance of commissioning activities.
5. Update the construction schedule periodically with commissioning progress and activities.
6. Review and comment on the Cx Plan prepared by the CxA.
7. Furnish continual updates of any construction related documents such as change orders, submittals, shop drawings, ASIs and RFIs to the CxA. Electronic files are acceptable.
8. The GC shall ensure the issuance of the requested submittals for review by the CxA when also issued to the Design Team.
9. Obtain and review the Trade Contractor IV, Startup and PFC blank forms and procedures prior to use.
10. Organize all Trade Contractor completed Cx forms/reports to be submitted to the CxA for review.
11. Evaluate issues and recommendations identified on the Cx Issues Log. The CxA will track the issues and recommendations according to the responsible entity. Collaborate with Trade Contractors and recommend corrective action. Assure resolution of all Cx issues.
12. Prepares O&M manual submittals for review by the Design Team and the Owner, and provides final manuals to the Owner.
13. Prepare a Training Plan including a schedule of all training, along with the Trade Contractor training agendas, and submit to Design Team, CxA and Owner for review.
14. Oversee the training of Owner's operating personnel and building occupants per approved training plan, schedule and agendas.
15. Assist the CxA in developing the Systems Manual with the assistance from the Trade Contractors.

N. Trade Contractors:

1. See the system / division specific commissioning specification sections for the Trade Contractor responsibilities.

1.8 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

O. Individual Divisions hold additional submittal requirements for commissioning. See the system / division specific commissioning specification sections for the Trade Contractor submittal requirements to the CxA for all associated pre-functional procedures/plans and blank forms.

P. Training Plan. The GC shall submit a comprehensive Training Plan per the requirements of the contract documents and specifications, including any required building occupant training in addition to O&M staff training. The CxA will review the Training Plan and provide any comments to the Design Professionals, GC and/or the Owner. The Training Plan shall include the following:

1. A list and schedule of all the training sessions.
2. An agenda for each training session, which includes:
   a. Equipment and/or systems covered;
   b. Recommended attendees;
   c. Proposed location;
   d. Estimated duration;
   e. Level of instruction to be provided and an outline of the training topics and subjects to be covered;
   f. List of any materials and handouts to be provided (or provided in advance);
   g. Company to provide the training and the instructor's name and qualifications.
3. A matrix of building O&M staff by position or name and specific training sessions they should attend. Consult with the Owner and/or building O&M staff to develop this matrix.

1.9 MISCELLANEOUS CONTRACTOR RESPONSIBILITIES

A. Means and Methods: The contractor is solely responsible for the means and methods of construction. While the CxA shall assist in interpretation of construction documentation, the final responsibility rests solely on the General Contractor and Installation Contractors.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST EQUIPMENT

A. The responsible Trade Contractor shall furnish all standard testing equipment required to perform the Startup, PFC and FPT tasks, unless stated otherwise in the system / division specific commissioning specification sections.

B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerance specified in the Contract Documents. If not otherwise specified, the following minimum requirements apply:

C. All equipment shall be calibrated according to the manufacturer's recommended intervals (or within one year if not otherwise specified) and recalibrated when dropped or damaged.

D. Calibration tags shall be affixed to or certificates readily available for all test equipment.

3.2 COMMISSIONING PLAN

A. The Commissioning Plan shall be developed by the CxA and delivered after the conclusion of the submittal process.

B. The sub contractors and contractors are responsible for reviewing the CxA documentation and provide comments to the CxA within 30 calendar days of receiving the commissioning plan. During this comment period the comments must be received in writing and the CxA will work with the individual contractors and sub contractors to ensure the safety of systems.

3.3 SCHEDULING AND COORDINATION

A. The CxA will provide an initial list of commissioning activities, milestones and deliverables to the GC for scheduling purposes.

B. The GC shall integrate all commissioning activities, milestones and deliverables into the master construction schedule with assistance and input from the CxA.

C. The GC shall provide sufficient notice to the CxA and Owner for scheduling and coordinating commissioning activities. A minimum 10 days' notice shall be provided to the CxA for witnessing equipment Startups, PFC and FPT tasks.

D. The Commissioning Team shall address scheduling problems and make necessary modifications in a timely manner in order to expedite the commissioning process.

3.4 MEETINGS

A. When commissioning team member attendance is required, as determined by the CxA and GC, team members shall be punctual and attentive during the meeting.

B. Coordination Meetings (MEP Meetings)

1. The CxA will attend the contractors MEP meeting per scope of work.
2. The purpose of these meetings is to coordinate installation, commissioning, and testing activities. These meetings will be conducted by the contractor with remote options.

C. The CxA will conduct a commissioning kick-off meeting, usually within 60 days of the commencement of construction. All team members involved in the commissioning process shall attend the kick-off meeting.

1. The General Contractor shall ensure that the following individuals are in attendance:

a. The Mechanical Foreman and Project Manager
b. The General Foreman and Project Manager
c. The Temperature Controls Foreman and Project Manager
d. The Test and Balance Project Manager
e. The Electrical Foreman and Project Manager
f. The Fire Protection Foreman and Project Manager
g. The General Contractor Project Engineer, Superintendent, and Project Manager

D. The CxA will plan other commissioning meetings as deemed necessary as construction progresses. These meetings will cover planning and coordination, Cx tasks and documentation, and Cx issues resolution.

E. The frequency of meetings will vary through construction, but generally increase during startup and commissioning activities. (*per scope of work*)

F. The CxA will write and distribute meeting minutes documenting the meeting discussion, conclusions, and actions for each team member.

3.5 SUBMITTAL REVIEWS

G. The CxA will review major equipment Division 23 submittals. To avoid duplication of comments, all subittal review comments prepared by the CxA will be forwarded to the Engineer for review and inclusion in their own comments as appropriate. The Architect will be responsible to coordinate the submittals with the CxA and the Engineer.

H. The submittal review process shall be coordinated between the Architect, the CxA, and the Engineer in such a manner that the CxA provides their review comments to the Engineer within 7 days of the submittal being issued. The Engineer will then review the CxA review comments, and will issue a single set of review comments to the contractor that addresses all items as deemed appropriate.

3.6 PRE-FUNCTIONAL TASKS

A. See the specific system / division commissioning specifications.

B. The Pre-Functional Checklists shall be reviewed by the CxA and shall be executed by the contractors and subcontractors.

C. The CxA shall review a percentage of all General systems installations.

D. The CxA will not begin Functional Testing of the system or any equipment until the pre-functionals checklists, startups, point to points, and balancing reports are received. While some systems can be tested without a complete system, the CxA will have the final say on which system can and cannot begin functional testing based on the completeness of the project.

E. Mockups or first installations of individual items of equipment that are representative of multiple installations shall be installed in the appropriate location for review by the CxA (per scope) and the Engineer. The contractor shall coordinate observations of First Installs within onsite scheduled meetings and shall not prohibit observations of First Installs. Subcontractors, Owner’s

Representatives, and Engineers shall review each of the First Installs for compliance prior to proceeding with subsequent installations of the same type.

3.7 FUNCTIONAL PERFORMANCE TESTS

A. See the specific system / division commissioning specifications.

3.8 COMMISSIONING ISSUES, BACK-CHECKS AND RE-TESTS

A. All Cx issues shall be corrected promptly. The responsible party shall correct the issue and inform the GC and CxA of the resolution and completion date. The CxA will record completion on the Cx Issues Log after a successful witnessed re-test, field review, back-check, verification obtained through appropriate documentation or photographs, review of the written resolution or documentation, or acceptance by the Design Team or Owner.

B. Where sampling is used for the PFC and FPT, the results shall be deemed acceptable once all noted issues are resolved and any new sample tests or checks have passed.

C. The CxA will witness one (1) re-test or will perform one (1) field back-check or verification of any Cx issue.

D. The CxA's total onsite time for re-test witnessing and field verification or back-check of Cx issues will be limited to no more than (2 days) for all applicable mechanical, electrical, and plumbing systems in the commissioning scope. (*if applicable per scope*)

E. The Owner may back-charge the GC for any additional fees from the CxA, resulting from any additional re-testing or field back-checks or verification beyond this allocated total time.

F. Trending points will be outlined in the Procedural Standards as delivered by the CxA in the commissioning plan.

1. A minimum of four weeks of 'Clean' trending (no mechanical, software, control loop, or Building Management System failures) shall be provided on 'Any' or 'All' BMS systems and points as directed by the CxA. Trends shall be coincident at 15 minute intervals with a cache able to handle four weeks of trending on a rollover basis. The trending shall also be set up to include a change of value or on/off (whichever is less intrusive to the network) in conjunction with the 15 minute requirement if possible
2. The CxA will review the trends after the four weeks of clean trending

3.9 TRAINING

A. The CxA shall be invited to all general training sessions by the general contractor. *(per scope)*

B. The training shall not commence until the system has been commissioned and proven ready for training.

C. The contractor shall schedule and coordinate training sessions for the Owner's staff for each system. Training shall be in a classroom setting with the appropriate schematics, handouts, and visual/audio training aids on-site with equipment.

D. The Commissioning Authority shall review agendas, which shall be submitted at least four weeks before training, and shall audit the training sessions. The agenda shall include but not limited to operational setpoints, runtime schedules, general operation and maintenance requirements, time and location for the training.

E. The training program shall include the following:

1. Emergency instructions and procedures
2. Operation instructions and procedures
3. Troubleshooting procedures
4. Maintenance and inspection procedures
5. Repair procedures
6. Upkeep of the systems manual and associated maintenance documentation logs

F. The contractor shall provide a schedule for training times and dates. The schedule shall include location, who is training, and trainers contact information,

G. The appropriate installing contractors shall provide training on all the major systems per specifications, including peculiarities specific to this project.

H. The equipment vendors shall provide training on the specifics of each major equipment item including operation, troubleshooting, and repair techniques.

3.10 COMMISSIONING ACCEPTANCE, CLOSEOUT AND REPORTING

A. Completion of the main commissioning activities (system readiness checks, functional performance tests, and training) shall be accomplished as a prerequisite for substantial completion. Completion of any re-testing shall be completed prior to final acceptance of commissioning.

B. After completion of the main commissioning activities and following review of the completed commissioning documents, test results and the current Cx Issues Log with the Owner, the Owner will indicate whether they accept completion of the project construction phase commissioning or if not, the requirements for acceptance. Upon Owner acceptance, any remaining open Cx issues will be transferred to the warranty phase Cx Issues Log for tracking resolution and completion as part of the warranty phase commissioning.

C. Upon completion of all commissioning activities, the CxA will prepare and submit to the Owner a Cx Report detailing all completed commissioning activities and documentation. The GC shall support this effort by providing all Trade Contractor commissioning documentation.

END OF SECTION

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 03 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 in all interior slab joint locations, except at polished slabs.

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. Concrete on Metal Deck

1. Concrete on metal deck shall contain hardrock aggregate conforming to ASTM C330, 1.5 lb/cy fiber reinforcing, and the specified shrinkage reducing admixture and shall achieve a maximum unit weight of 130 pcf and conform to the properties listed in the following table.

Location	Req'd. 28 day Compressive Strength	Maximum Water Cement Ratio	Air Content
Slab on metal deck	4000	0.45	1% - 3% (entrapped)

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.

E. Concrete Slabs on Deck
1. Provide 1” deep tooled or sawcut control joints as noted on the drawings.
2. Except at polished slabs, seal all expansion and contraction joints with the here-in specified joint sealing compound.
3. 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.
   f. Areas delineated for local measurements on the Drawings.

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 and for Interior Slabs to be Left Exposed: Curing compound shall be fully compatible with all flooring adhesives to be used on the Project and guaranteed by the manufacturer, in writing, not to impair bonding adhesive. 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
b.	Elevated slabs:	Specified Overall Value =	FF 35
		Minimum Local Value =	FF 25

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”
b.	Elevated slabs:	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 2000 psi at 28 days. See Architectural drawings for layup pattern and mortar joint locations. Design F'm = 2000 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 04 41 00 – CORNERSTONE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
1.
2. 1. Granite cornerstone enclosure and copper urn.

B. Related Sections:
1.
2. 1.Division 4 Section “Concrete Unit Masonry” for surrounding masonry walls.

1.3 SUBMITTALS

A. Shop Drawings: Submit complete shop drawings for fabrication and erection, including plans, elevations, and large-scale details of typical sections and connections.
1.
2. 1.Provide layout, dimensions, and identification of each unit corresponding to sequence of installation and installation procedures.
3. 2.Provide location and details of anchorage devices to be embedded in or fastened to other construction. Furnish templates if required for accurate placement.

B. Selection Samples: For initial selection of colors and textures, submit manufacturer’s color charts consisting of actual product pieces, showing full range of colors and textures available.

C. Verification Samples: Provide samples of minimum size as follows:
1.
2. 1. Polished granite: 6 inches square.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1.
2. Obtain required products from a single manufacturer.
3. Accessories: Provide accessory items only as produced or recommended by manufacturer of primary products.

B. Manufacturer Experience: Provide products of this section by companies which have successfully specialized in production of this type of work for not less than 3 years.

1.5 WARRANTY

A. Special Project Warranty: Submit a written warranty signed by the manufacturer, the contractor, and the installer, guaranteeing to correct failures in materials and workmanship which occur within the warranty period, including those attributable to abnormal aging, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents.
   1.
   2. The warranty shall include responsibility for removing and replacing other work as necessary to accomplish repairs or replacement of materials covered by the warranty.

PART 2 - PRODUCTS

2.1 CORNERSTONE

A. The design is based on the following product: Granite cornerstone, two inches thick, polished face with engraved inscription; Chilcoot Monument Company, 94076 Highway 70, P.O. Box 190, Chilcoot, CA 96105, (916) 993-4694.
   1.
   2. Colors: As selected by Architect from manufacturer's full range.
   3. Highlight letters and numbers with "Lithochrome".
   4. Size 23-3/8 inches wide by 15-3/8" high.
   5. Location: to be located in cmu wall near main entry – exact location to be determined by architect and owner in field.
   6. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.2 ACCESSORIES

A. Copper Urn:
   1.
   2. 1.Urn shall be approximately 19 inches wide x 12 inches high x 4 inches deep. The urn and cover shall be fabricated of 16-ounce soft copper. All joints shall be weather and watertight. A 1/2 inch "S" crimp shall be on the inside of the urn and the cover shall fit into the crimp and then be soldered. No acid is to be used in the solder. The urn must fit into the cavity in the granite enclosure.

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 fully resolved.

3.2 INSTALLATION

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Tolerances: Install products of this section to within the following tolerances:
   1. Plus or minus 1/16 inch.

C. Prepare rough opening in masonry wall for cornerstone installation concurrent with assembly of masonry wall. Protect rough opening from moisture and damage prior to installation of cornerstone. Cornerstone may be temporarily installed prior to final installation. Final installation will follow formal ceremony after Substantial Completion.

D. General contractor shall coordinate final installation of cornerstone 1 Year after Substantial Completion. General Contractor shall provide a temporary painted sheet steel enclosure within opening until final installation.

3.3 CLEANING

A. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces.
   1.
   2. 1.For cleaning, use only products and techniques acceptable to the manufacturer of products being cleaned.

3.4 PROTECTION

A. General: Institute protective procedures and install protective materials as required to ensure that work of this section will be without damage or deterioration at substantial completion.

3.5 END OF SECTION 04 41 00

1.

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 COMPOSITE FLOOR 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.; a Blue Scope Steel company.
2. Nucor Corp.; Vulcraft Group.
3. Verco Manufacturing Co.
4. EPIC Metals Corporation.
5. New Millennium Systems

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more wherever possible.
6. Side Laps: As required for specified connections.
7. All composite floor deck shall be unvented.

2.4 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 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: Space and locate welds 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 or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 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.

3.6 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.
3. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall 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 ROOF-RAFTER FRAMING

A. Steel Rafters: 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 13 - METAL PAN STAIRS

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. Preassembled steel stairs with concrete-filled treads.

B. Related Requirements:

1. Section 03 30 00 - "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 05 52 13 - "Pipe and Tube Railings" for pipe and tube railings.
3. Section 05 73 00 - “Decorative Metal Railings” for Ornamental Railing.
4. Section 09 91 23 - “Interior Painting”.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Prefilled metal-pan-stair treads.
2. Abrasive nosings.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

2.3 ABRASIVE NOSINGS

A. Cast-Metal Units: Cast aluminum, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Manufacturers: Subject to compliance with requirements, available manufacturers include, but are not limited to the following:

a. American Safety Tread Co., Inc.
b. Balco, Inc.
c. Safe-T-Metal Company, Inc.
d. Wooster Products Inc.

2. Configuration: Solid abrasive, 3 inches wide.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

2.4 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be shop primed with zinc-rich primer.

2.5 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply 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. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flathead (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.7 STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel tubing.

    a. Provide closures for exposed ends of stringers.

2. Construct platforms of steel tubing headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld stringers to headers; weld framing members to stringers and headers.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Steel Sheet: Uncoated cold-rolled steel sheet unless otherwise indicated.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they are concealed by concrete fill. Do not weld risers to stringers.
3. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

D. **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.**

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

END OF SECTION 05 51 13

SECTION 05 51 33 - ALUMINUM LADDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum Ships Ladder.

B. Aluminum Roof Cross-over Ladders

C. Aluminum Roof Landings

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 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.

2.2 MEZZANINE 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 inch by 2 inch by 3/16 inch extruded 6061-T6 aluminum channel. Pitch: 75 degrees.
6. Ladder Mounting Brackets:
    a. Floor Bracket: 2 inch by 3 inch by 1/4 inch aluminum angle.
    b. Top Bracket: 4-3/4 inch by 5 inch by 1/4 inch aluminum angle.
7. Handrails: 1-1/4 inches Schedule 40, 6061-T6 aluminum pipe provided with cast aluminum fittings.
    a. Railing Top Extension: 42" Above top Tread.

2.3 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: 75 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.

2.5 ROOF CROSSOVERS ALUMINUM LADDERS

A. Provide aluminum ladder type crossovers at roof where indicated.

1. Capacity: Unit shall support a 500 lb. total load without failure
2. Width: 24”.
3. Length: As required.
4. Treads: 2 1/4” wide serrated mounted at 12” centers.
5. Ladder Stringer: 2 ½” extruded 6005-T5 aluminum channel. Pitch: 90 degrees.
6. Ladder Mounting Brackets:
    a. Wall Bracket: 3 inches by 8 ½” inches by 1/4-inch aluminum angle.
7. Handrails: 2 ½” extruded 6005-T5 aluminum channel.

2.6 ROOF LANDINGS

A. Provide aluminum landings at roof where indicated.

1. Capacity: unit shall support a 500 lb. total load without failure.
2. Width: 48 inches.
3. Length: 48 inches.
4. Landing Surface: Standard aluminum expanded metal.
5. Landing frame: Min. 2” x 2” x 3/16” extruded 6005-T5 welded aluminum angle, bolted to supports.
6. Support Legs: Min 2” sq. x 3/16” extruded 6005-T5 aluminum tube bolted to metal roof deck.
    a. Coordinate with roofing supplier.

2.7 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.

2.8 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 05 52 13 - PIPE AND TUBE RAILINGS

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 steel tube and stainless-steel woven wire mesh panel railings.

2. Interior stainless steel pipe handrails.

B. Related Requirements:

1. Section 05 51 13 - "Metal Pan Stairs" for stair stringers, pans, and treads associated with pipe and tube railings.
2. Section 09 91 13 - "Interior Painting" for paint finishes of metal pipe and tube railings.
3. Section 09 93 00 - "Staining and Transparent Finishing" for wood rails.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stainless-Steel Woven Mesh:

1. Basis-of-Design Product: Subject to compliance with requirements, provide McNichols SS/304 – 1” Opening .120 Icmp3 Sht. (Model No. 38922200SA) or comparable product in accordance with Division 1 Section “Product Requirements”.
   a. Mill Finish
   b. Woven – Intercrimp Weave
   c. 80% Open Area

B. Stainless Steel and Steel Bar Components:

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. Julius, Blum & Co., Inc.
   b. Livers Bronze Co.
   c. R & B Wagner, Inc.

C. Source Limitations: Obtain each type of railing from single source from single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. See Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.4 STEEL AND IRON

A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

2.5 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 304.

B. Pipe: ASTM A 312/A 312M, Grade TP 304.

C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

D. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.

E. Bars and Shapes: ASTM A 276, Type 304.

F. Woven-Wire Mesh: Intermediate-crimp, rectilinear pattern, woven-wire mesh, made from 0.120-inch nominal diameter wire complying with ASTM A 580/A 580M, Type 304.

2.6 FASTENERS

A. General: Provide the following:

1. Provide stainless steel exposed fasteners with finish matching appearance, including color and texture, of stainless-steel woven wire mesh.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

2.7 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

1. 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.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Wood Rails: Clear, straight-grained hardwood rails secured to metal tubing.

1. Species: Maple.

2. Finish: Clear, refer to Division 9 Section "Staining and Transparent Finishing".
3. Staining: Match Architect's sample.
4. Profile: As indicated on drawings.

2.8 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form Changes in Direction as Follows:

1. As detailed.
2. By radius bends of radius indicated.

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.9 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

E. **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.**

2.10 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

C. Dull Satin Finish: No. 6.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.11

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space

between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

3.5 ATTACHING RAILINGS

A. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.6 ATTACHING WOVEN MESH

A. Fastener ends shall be covered to prevent injury to students. See architectural details for covering method. No exposed bolt ends will be allowed, on either public or non-public side of guardrail.

3.7 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

B. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

C. Clean wood rails by wiping with a damp cloth and then wiping dry.

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 52 13

SECTION 05 75 00 - DECORATIVE FORMED METAL

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 perforated metal screen panels at Stair 2.
2. Galvanized Steel Bar Grating at structural steel canopies.
3. Steel gate louvered infill panels at Gas Enclosure, Transformer Enclosure, and Trash Compactor Enclosure.

B. Related Requirements:

1. Section 09 91 33 - “Exterior Painting”.

1.3 COORDINATION

A. Coordinate installation of anchorages for decorative formed metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

B. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes of deterioration.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Show fabrication and installation details for decorative formed metal.

1. Include plans, elevations, component details, and attachment details.
2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square Samples of metal of same thickness and material indicated for the Work.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, and professional engineer.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance as well as sufficient production capacity to produce required units.

B. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

B. Store products on elevated platforms in a dry location.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design decorative formed metal, including attachment to building construction.

B. Structural Performance: Decorative formed metal items, including anchors and connections, shall withstand the effects of gravity loads and the following loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:

1. Wind Loads on Exterior Items: As indicated on Drawings.

C. Seismic Performance: Exterior decorative formed metal items, including anchors and connections, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F , material surfaces.

2.2 SHEET METAL

A. General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Aluminum Sheet: Flat sheet complying with ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of not less than Alloy 5005-H32.

C. Steel Sheet: electrolytic zinc-coated, ASTM A 879/A 879M, with steel sheet substrate complying with ASTM A 1008/A 1008M, commercial steel, exposed.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.

B. Structural Anchors: For applications indicated to comply with certain design loads, provide fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.

C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch-wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch and support with concealed stiffeners.

D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.

1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.

F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.

G. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

1. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.

2.5 EXTERIOR PERFORATED METAL SCREEN PANELS AT STAIR 2 EXTERIOR

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. ZAHNER; IMAGEWALL Panel System
2. Dri-Design - Wall Panel System; Product Perforated Series
3. Accurate Perforating Company, Inc.

B. Form exterior formed-metal-shaped panels from metal of type and thickness indicated below.

1. Aluminum Sheet: Thickness required to comply with performance requirements, but not less than .080 inch.

a. Finish: Baked enamel or powder coat.

1) 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.

b. Perforation Pattern: Custom electronic image-based pattern to be selected and provided by Architect.

c. Perforated sheets shall be deburred. Product shall be free of sharp edges at corners, panel edges and perforations. Perforation holes shall be deburred from both sides of product sheet.

C. Hardware and frame system:

1. Exterior formed-metal-shaped panel systems shall include structural aluminum frame, mullions, hardware, and drop locks as required to comply with performance requirements and as required for a complete proper installation of panel system by the installer.
2. Where possible, contact between dissimilar metal surfaces shall be avoided. Where contact occurs isolate the surfaces, as follows:

a. Ferrous metals in contact with stainless steel shall be painted with Bituminous paint complying with FS-TT-C-494, Type II, 12 mils dry film thickness.
b. Taping or gasketing with a non-absorptive material.

3. Attach frame to CMU wall using stainless steel fasteners.

2.6 GALVANIZED STEEL BAR GRATING

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. McNICHOLS Welded Bar Grating
   a. Product: CMW-4-150 Close Mesh Series, ADA, 11-W-4
   b. Bearing Bar Size - 1-1/2" x 3/16" at 11/16" o.c.
   c. Welded cross bars at 4" o.c.
   d. Clear space between bearing bars shall be ½".
   e. Width: 36" wide panels
   f. Length: As required
   g. Surface: Smooth
   h. Finish: Hot Dipped Galvanized
   i. Fasteners: Type CB Saddle Clip, galvanized as required, at each panel corner.
   j. Utilize Stainless steel self-tapping screws designed to withstand design loads. Provide exposed fasteners with neoprene bonded sealing washers.

2.7 LOUVERED GATE INFILL

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. BarnettBates Orsogril® 800-541-3912 (www.barnettbates.com) custom fabrication of required components, or equal as approved by architect. Basis of Design Product: BarnettBates Orsogril® Talia-100 100% view-blocking louver. 1/16" (2mm) thickness overlapping formed sheet metal louvers in horizontal position to effectively block sight lines from below. Louvers positioned and held in place by 5/32" round crossbars at 5 7/32" centers. Custom engineered panel system banding/framing/mounting clips per fabrication detail, or equal.

2. Materials:
   a. Steel Bar Stock ASTM A36
   b. Steel Tubing ASTM A500, Grade B

3. Fabrication:
   a. Electro-forge welding Infill panels electro-forge welded for complete weld penetration of crossbar.
   b. Fabrication per shop drawings All supplied components will be fabricated per detail shop drawings supplied by manufacturer.
   c. NAAMM Prior to shipment, all fabricated components will be analyzed and meet standard NAAMM steel fabrication requirements and tolerances.
   d. OSHA / BOCA Fabricated components, when installed properly will meet applicable OSHA, and/or BOCA loading requirements.

4. Finish:
   a. BarnettBates Orsogril® 20-year Warranty Finish System. All supplied components will be finished with this system (or equal if approved by architect).
   b. All fabricated product to be 100% sandblasted to white metal for removal of scale, oil and debris to create a minimum 2mil etching for proper adhesion.
   c. Electrostatic application of DuPont Gray Morning epoxy powder primer with 375f. minimum 15-minute duration heat cure for maximum corrosion protection.
   d. Immediate electrostatic application of DuPont TGIC polyester powder color coat while metal temperature is minimum of 300f. and heat cure for minimum 10 minutes at 400f.
   e. Colors: Color to be selected from the manufacturer's standard colors.

2.8 ALUMINUM FINISHES

A. Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.9 STEEL FINISHES

A. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."

B. Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating.

C. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils. Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

D. Galvanized Bar Grating shall not be painted.

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 decorative formed metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.

1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.

E. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior decorative formed metal items soundproof or lightproof as applicable to type of fabrication indicated.

F. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

A. Unless otherwise indicated, clean metals by washing thoroughly with water and soap, rinsing with clean water, and drying with soft cloths.

B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting."

D. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 05 75 00

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 Bench Platforms in Student Hub.

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.

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

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

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).
   3. Solid-surfacing-material countertops.
   4. Solid-surfacing-material countertop w/integral sink
   5. Solid-surfacing-material back splash

B. Related Sections:
   1. Section 08 56 53 - “Transaction Security Windows” for deal trays recessed in solid-surfacing countertop at transaction window.
   2. Section 09 93 00 - “Staining and Transparent Finishing” for coating exposed wood cleats and supports beneath countertops.

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.
   4. Solid-surfacing materials.

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.

E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   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

F. Integral Sinks (Classrooms): Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart AV 1513, or comparable products by one of the following:
      a. DuPont Corian
      b. Formica Traditions
   2. Color:
      a. Integral Sinks: Designer White

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 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Solid-Surfacing-Material Thickness: .40 inch.

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
   1. Formica Traditions: #607 Ashen Concrete.

C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
   1. Fabricate tops with shop-applied edges of materials and configuration indicated.
   2. Fabricate tops with loose backsplashes for field application.
   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.

D. Drill holes in countertops for faucet and bubbler in the field per the Drawings.

PART 3 - EXECUTION

3.1 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.

3.2 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.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   3. Secure backsplashes to walls with adhesive.
   4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
   5. Finish wood cleats or supports beneath countertops with a coat of clear varnish.

3.3 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 06 42 16 - FLUSH WOOD PANELING

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. Flush wood paneling.
2. Metal furring, blocking, shims, and hanging strips for installing flush wood paneling unless concealed within other construction before paneling installation.
3. Shop finishing of flush wood paneling.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, fire-retardant-treated materials, and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.

1. Show details full size.
2. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
3. For paneling produced from premanufactured sets, show finished panel sizes, set numbers, sequence numbers within sets, and method of cutting panels to produce indicated sizes.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Fabricator.

B. Product Certificates: For each type of product.

C. Evaluation Reports: For fire-retardant-treated materials and fire-retardant-treated paneling, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver paneling until painting and similar operations that could damage paneling have been completed in installation areas. If paneling must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature between 60 and 90 deg F and relative humidity between 17 and 50 percent during the remainder of the construction period.

C. Field Measurements: Where paneling 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 paneling by field measurements before being enclosed and indicate measurements on Shop Drawings.

D. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to established dimensions.

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 paneling can be installed as indicated.

PART 2 - PRODUCTS

2.1 PANELING, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of flush wood paneling indicated for construction, finishes, installation, and other requirements.

2.2 FLUSH WOOD PANELING

A. Grade: Custom.

B. Available Products and Manufacturer's: Subject to compliance with requirements, available manufacturer's offering products that may be incorporated into the Work include, but are not limited to:
1. Roseburge – Medite FR MDF
2. Interlam – Flakeboard Premier FR MDF
3. Royal Plywood Company – FR MDF

C. Panel-Matching Method: No matching is required between panels. Select and arrange panels for similarity of color between adjacent panels.

D. Panel Construction: Fire-retardant particleboard or fire-retardant, medium-density fiberboard.

1. Thickness: As indicated.
2. Perforations: Panels shall have 6mm holes, 16mm O.C. where indicated on Drawings.

E. Exposed Panel Edges: 1/8" chamfer and machined edge.

F. Fire-Retardant-Treated Paneling: Panels shall consist of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard. Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E 84 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. Assemble panels by gluing and concealed fastening.

2.3 MATERIALS

A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

B. Wood Moisture Content: 4 to 9 percent.

C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.

D. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.

2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

2.5 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant 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 metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls.

C. Concealed Cleat: Fry Reglet MWCLEAT25 or equal.

D. Aluminum Edge Trim: Fry Reglet MWPT50 or equal.

1. Finish: Clear Anodized.
2. Location: As indicated on Drawings.

E. VOC Limits for Installation Adhesives: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Contact Adhesive: 80 g/L.

2.6 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Complete fabrication, including assembly and finishing, 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.

C. 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.

2.7 SHOP FINISHING

A. General: Finish paneling at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing paneling, as applicable to each unit of work.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: System - 12, water-based polyurethane.
3. Staining: None required.
4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition paneling to average prevailing humidity conditions in installation areas.

B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install paneling to comply with same grade as paneling to be installed.

B. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

C. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless otherwise indicated.

D. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

E. Refer to Section 09 93 00 "Staining and Transparent Finishing" for final finishing of installed paneling.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective paneling, where possible, to eliminate defects; where not possible to repair, replace paneling. Adjust for uniform appearance.

B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 42 16

SECTION 07 11 10 - COMPOSITE SHEET WATERPROOFING

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
   1. Division 3 Section "Cast-in-Place Concrete" for concrete placement, curing, and finishing.

1.2 SUMMARY

A. Section Includes:

   1. Composite sheet waterproofing at site retaining walls.

1.3 ACTION SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data: For each type of product.

   1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

C. Shop Drawings showing locations and extent of waterproofing, including details for substrate joints and cracks, sheet flashings, penetrations, tie-ins with adjoining construction, and other termination conditions.

D. Samples: For each exposed product and for each color and texture specified, including the following products:

   1. 8-by-8-inch square of composite waterproofing product.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who is certified in writing by waterproofing manufacturer as qualified to install manufacturer’s waterproofing.

B. Single-Source Responsibilitv: Obtain waterproofing materials from a single manufacturer regularly engaged in manufacturing waterproofing.

C. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer’s name, product, date of manufacture, and directions for storage.

D. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer. Protect stored materials from direct sunlight.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.6 PERFORMANCE REQUIREMENTS

A. General: Provide waterproofing that prevents the passage of liquid water under hydrostatic pressure and complies with requirements as demonstrated by testing performed by an independent testing agency of manufacturer’s current sheet membrane.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. General Warrantv: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of five years.

1. Special Warranty: Submit a written warranty signed by waterproofing manufacturer and Installer agreeing to repair or replace waterproofing that does not meet requirements or that does not remain watertight during the specified warranty period. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch (1.6 mm) in width.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, from single source from single manufacturer.

B. COMPOSITE DRAINAGE PANELS

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Basis of Design: Mirafi G100NC Drainage Composite as manufactured by TenCate Geosynthetics Americas (A Solmax Company), 365 South Holland Drive, Pendergrass, GA 30567, 1-706-693-2226, www.tencatgeo.us

2. Composite drainage panels, 3-dimensional, nonbiodegradable, manufactured with a permeable geotextile bonded to molded-plastic-sheet drainage core and designed to effectively convey water.

3. Geotextile: Nonwoven geotextile fabric of polypropylene or polyester fibers, or combination of both.

a. Maximum Flow Rate: 21 gpm/foot (261 L/min/m) when tested according to ASTM D 4716.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas. and conditions under which waterproofing systems will be applied, with Installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. Do not proceed with installation until after minimum concrete curing period recommended by waterproofing manufacturer.

2. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

3. Notify Architect in writing of anticipated problems using waterproofing over substrate.

3.2 SURFACE PREPARATION

A. Clean, prenare, and treat substrate according to manufacturer’s written instructions. Provide clean, dust- free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage affecting other construction. Hemove grease, oil, form release ailents, naints, and other penetrating contaminants from concrete.

C. Remove fins, riddles, mortar, and other protections and fill honeycomb, aggregate pockets, holes, and other voids.

D. Prepare, fill, nrime. and treat ioints and cracks in substrate. Remove dust and dirt from joints and cracks according to ASTM D 4258.

E. Inside Corners: Prepare, prime, and treat inside corners according to waterproofing manufacturer's written instructions.

F. Outside Corners: Prepare and treat outside corners according to waterproofing manufacturer's written instructions.

G. Prenare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to waterproofing manufacturer's written instructions.

3.3 DRAINAGE PANEL INSTALLATION

A. Place and secure drainage panels according to manufacturer's written instructions. Use adhesives and mechanical fasteners recommended by manufacturer that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed panela during subsequent construction.

3.4 PROTECTION, REPAIR, AND CLEANING

A. Protect waterproofing from damage and wear during application and remainder of construction period, according to manufacturer's written instructions.

END OF SECTION 07 11 10

SECTION 07 13 26 - SELF-ADHERING SHEET WATERPROOFING

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. Modified bituminous sheet waterproofing at Elevator Pit and Site Concrete and/or CMU Planters and Landscaping walls.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Samples: For each exposed product and for each color and texture specified, including the following products:

1. 8-by-8-inch square of waterproofing and flashing sheet.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

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. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
b. GCP Applied Technologies Inc. (formerly Grace Construction Products); Bituthene 4000.
c. Polyguard Products, Inc; Polyguard 650 Membrane.
d. W.R. Meadows, Inc; Mel-Rol.

2. Physical Properties:

a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

G. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch thick.

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 waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

F. Bridge and cover isolation joints discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.

E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

F. Seal edges of sheet-waterproofing terminations with mastic.

G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

I. Immediately install protection course with butted joints over waterproofing membrane.

3.4 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 13 26

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.

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. Extruded-Polystyrene board insulation.
2. Polyisocyanurate board insulation
3. Glass-fiber blanket insulation.
4. 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.

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. 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.

C. 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.

D. Thickness: 2-1/2, 3-5/8, 6, or 8 inches as indicated on Drawings.

E. 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

F. 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. 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. 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.

C. Thickness: 1 inch.

D. 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. 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.

4. Panel Coverage: 36 inches.
5. 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. Vapor Retarder
3. Roof insulation.
4. 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: A flood test of the completed roof system shall be conducted by the Contractor in the presence of the Washoe County School District representative. 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.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
2. Plug all roof drains in each drainage area and fill each to a depth of 4 inches minimum measured at the drain areas. Allow to stand for a minimum of 48 hours.
3. ASTM D 5957 sets 24 hours as minimum and 72 hours as maximum duration for flood testing.
4. Flood each area for 48 hours.
5. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

6. Contractor shall provide and/or arrange for all necessary equipment, supplies, water, etc. as needed to perform these tests. This may include a water truck with fire hose, if necessary.
7. Contractor shall make all required corrections due to defects noted during or after these tests.
8. Flood test must be completed and verified prior to filing for Substantial Completion.
9. 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.

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, 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: 97 psf
2. Perimeter Uplift Pressure: 97 psf.
3. Field-of-Roof Uplift Pressure: 115 psf.
4. Based upon an Ultimate Design Wind speed of 140 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 built-up 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. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

F. 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”.

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 sheet flashing 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.

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. Masonry Reglet for Installation in Masonry Joints: 4 inch (101 mm) top flange with 1-1/8 inch (29 mm) vertical stepped face for masonry application; integral lock strip to engage spring-action flashing.
2. Masonry Reglet for Installation in Saw-Cut Masonry Joints and at Mechanical Penthouse Door Sill: 1-1/8 inch (29 mm) top flange with 1-1/8 inch (29 mm) vertical stepped face for masonry application; integral lock strip to engage springaction flashing.
3. 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 or plastic 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 VAPOUR RETARDER SA 31, by SIKA 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, fiber reinforced felt 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. GAF; Energy Guard PolyIso Roof Insulation.
b. Firestone 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, A Carlisle Company; EPS Geofoam.

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 spray-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. CertainTeed Corporation; GlasRoc Sheathing.
b. Georgia-Pacific Building Products; Dens Deck.
c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
d. 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 workday or when rain is forecast. 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. 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 6 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. Fasten first and second layers 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 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 6 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 and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

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. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

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 7Soffit 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.

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 60 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 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 included in 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 bituminous coating or by other permanent separation as recommended by manufacturer.

1. Bed flanges in thick coat of asphalt 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. Embedded Reglets: See Section 04 20 00 "Unit Masonry" for installation of reglets.

C. 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-50 Roof Hatch or comparable product by one of the following:

a. JL Industries, Inc
b. Nystrom, Inc.

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 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. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Underlayment:

1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
2. 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:
3. 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.
4. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

E. 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.

F. 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 bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating 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 asphalt 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.

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.

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

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 1.

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.

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.

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.

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.

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. 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.

C. 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 07 95 13.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor expansion joint covers.
2. Wall expansion joint covers.
3. Ceiling expansion joint covers

B. Related Requirements:
1. Related work includes but is not limited to:
   a. Cast-In-Place Concrete: Section 03 30 00.
   b. Concrete Unit Masonry: Section 04 22 00.
   c. Cold-Formed Metal Framing: Section 05 40 00.
   d. Non-Structural Metal Framing: Section 09 22 16.
   e. Joint Sealants: Section 07 92 00
   f. Gypsum Board: Section 09 29 00.

1.2 REFERENCES

A. Work shall be performed following applicable Local, State, and Federal codes and regulations.

B. Publications listed herein are part of this specification. See below for standards where applicable to the product listed:

1. American Society for Testing and Materials (ASTM):
   a. ASTM B221, “Standard Specifications for Aluminum and Aluminum-Alloy Extrusions.”
   b. ASTM B209, “Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
   c. ASTM E1399 “Cyclic Movement and Measuring of Minimum/Maximum Joint Widths of Architectural Joint Systems.” IPC.3087/Rev.6
   d. ANSI/U.L. No. 263, UL2079, ULCS115, EN1366-4 Fire Rated Testing fort full rated period. Underwriter’s Laboratories shall classify adjacent substrate assemblies.
   e. ASTM E1612, Standard Specification for Preformed Architectural Compression Seals for Buildings and Parking Structures.
2. American National Standards Institute (ANSI):
   a. ANSI A137.1/A326.3 (2018), “Method for Measuring Dynamic Coefficient of Friction on Hard Flooring Materials”

1.3 DEFINITIONS

A. Product Movement capabilities
1. Product operating range defined as a percentage of the nominal joint width.
2. Industry standard requirements: 25%+- operating range for thermal conditions. 50%+- operating range for seismic and windsway conditions.

3. Lateral shear capable systems allow for movement parallel to joint orientation.

B. Product “Load” descriptions:
   1. Standard Loads: common applications with high volume pedestrian crossing. Applicable for typical office settings or other spaces where occasional rubber wheeled traffic (i.e.- mail carts, trolleys, light weight cleaning equipment and luggage) will be encountered. 500 lb. [230 kg] maximum.

   2. Moderate Loads: suggests applications where occasional heavier maintenance equipment with soft rubber tires (such as gurneys, light duty scissor lifts, motorized cleaning equipment) would be added to the Standard traffic definition. The systems in this category are comprised of heavier aluminum extrusions and thicker walled extruded rubber seals. 1000 lb [450 kg] maximum.

   3. Heavy Duty Concentrated Loads: reserved for project conditions where heavy loads (i.e.- vehicles, mobile medical equipment, coin carts, materials handling equipment) are common. Capable of multi-directional movement and resistance to recurring lateral impact forces. Typical 2000 lb. [910 kg] maximum.

C. Joint coverplate systems shall permit daily thermal expansion and contraction of building elements, minor foundation settlement, and common windsway movements of the structure without disengagement.

D. Joint system details shall clearly indicate X-axis joint movement capabilities (horizontal contraction/ expansion). Y-axis joint movement (in-plane shear), and Z axis movement (vertical shear) may be requested of the Manufacturer if applicable.

E. Movement capabilities shall be clearly defined as a percentage of the nominal joint width or with distinct dimensions defined on product details.

F. Joint Systems shall allow for seismic movement (if applicable), matching requirements as defined within the Project Specific Structural Specifications.

G. Fire Rated Assemblies shall be tested by registered Third Party Testing Agencies in accordance with UL2079, ULC S115, or BS 476 classified systems. Expansion joint assembly fire rating shall match or exceed the fire rating of adjacent construction.

1.4 QUALITY ASSURANCE

A. Architectural Joint Cover Manufacturer: Furnish horizontal and vertical systems from a Manufacturer with a minimum of ten (10) years of experience in the design, engineering and fabrication of expansion joint systems.

B. Fire Rated Assembly Manufacturer: Furnish horizontal and vertical rated systems from a single Manufacturer to ensure compatibility. Intersection of/ or transition between dissimilar systems is not allowed unless reviewed and approved by AHJ.

C. Installer: Contractor with not less than three (3) years of successful experience in the installation of systems similar to those required by Project.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer’s Specifications, technical data, installation instructions, and detail drawings for each proposed system.

2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

    a. Floor expansion joint covers.
    b. Wall expansion joint covers.
    c. Ceiling expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

D. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion joint cover assembly.
2. Expansion joint cover assembly location cross-referenced to Drawings.
3. Nominal, minimum, and maximum joint width.
4. Movement direction.
5. Materials, colors, and finishes.
6. Product options.
7. Fire-resistance ratings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY AND STORAGE

A. Manufacturer to provide protective film on all exposed cover plate components.

B. Deliver joint systems to jobsite in new, clean, unopened cartons or crates of sufficient size and strength to protect materials during transit.

C. Inspect materials upon arrival. Store components in original containers in a clean, dry location. Ensure temperature or moisture sensitive components are stored in a tempered location.

D. Contractor to provide temporary protective covers on all installed finished surfaces. Protection is required to guard against both surface abrasions as well as overloading of horizontal deck components by construction traffic.

1.8 SEQUENCING

A. Submittals shall be completed and remitted to the Project Architect within 4 weeks after award of subcontract.

B. Subcontract for the work of this section shall be planned to allow sufficient time for Manufacturer’s production and delivery scheduling.

1.9 WARRANTY

A. Standard limited warranty against material and manufacturing defects for a period of not less than five (5) years when installed in accordance with Manufacturer’s recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer must be capable of providing a full range Interior and Exterior Architectural Joint Cover systems as well as a full complement of expansion joint accessories.

B. Manufacturer must be capable of providing project specific details accurate to the building construction type.

1.1 MATERIALS

A. Aluminum: Alloy types of 6061-T6, 6063-T6, 6005A, or 5052-H32 sheet goods

1. Floor systems: Mill finish standard.
2. Walls and Ceilings: Standard Class II Clear Anodized.

B. Stainless Steel: Alloy Type 304 for plates and strips.

1. Brushed #4 surface finish standard.

C. Elastomeric Seals: Synthetic rubber seals comprised of a dual extrusion Santoprene rubber for heat welding of all transitions and seams for a monolithic, weathertight installation. EPDM and Neoprene substitutions are not allowed due to their lack of ability to meet this specific requirement.

1. All Santoprene seals must be certified as low VOC as certified by UL Environmental GreenGuard Gold Certification

D. Horizontal and Vertical Moisture Barrier (optional accessory): Min. 45 mil thick fabric reinforced EPDM with optional watertight drain assemblies.

E. Horizontal and Vertical Insulated Moisture Barrier (optional accessory):

1. Min. R Value of 15
2. Must meet ASTM E1399 Cyclic movement requirements matching movement requirements specific to project.

2.2 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency.

1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies to be subjected to hose stream testing.

C. Expansion Joint Design Criteria:

1. Seismic Movement:
   a. Joint Movement:
      1) At or above second floor level: 2” relative movement.
      2) At or near the roof level: 4” relative movement

2.4 FLOOR EXPANSION JOINT COVERS

A. Dual Seal and Coverplate Joint Systems: Assembly consisting of center plate that slides over metal frames fixed to sides of joint gaps.

1. Basis-of-Design Product: Subject to compliance with requirements, provide #223-A01-100 (4") Recessed Mount Seismic Floor and Wall System, 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".
2. Manufacturers: Subject to compliance with requirements, products by one of, but not limited to, the following:
   a. Balco; a CSW Industrials Company.
   b. inpro Corporation.
   c. MM Systems Corporation.
   d. Nystrom, Inc.
3. Application: Floor to floor.
4. Installation: Recessed/Flush
5. Load Capacity:
   a. Uniform Load: 50 lb/sq. ft.
   b. Concentrated Load: 300 lb.
   c. Maximum Deflection: 0.0625 inch.
6. Fire-Resistance Rating: Not less than 2 hours.
7. Cover-Plate Design: Plain.
8. Exposed Metal:
   a. Aluminum: Mill finish.
      1) Color: Natural.

2.5 WALL EXPANSION JOINT COVERS

A. Surface Mount Glide-Plate System: Assembly consisting of center plate that slides in and out of slots in metal frames fixed to sides of joint gap.

1. Basis-of-Design Product: Subject to compliance with requirements, provide #300-A07-100 (4") Glide Plate Wall/Wall System, 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
2. Manufacturers: Subject to compliance with requirements, products by one of, but not limited to, the following
   a. Balco; a CSW Industrials Company.
   b. inpro Corporation.
   c. MM Systems Corporation.
   d. Nystrom, Inc.
3. Application: Wall to wall.
4. Fire-Resistance Rating: Not less than 2 hours.
5. Exposed Metal:
   a. Aluminum: Clear Anodized Class II finish.
      1) Color: Natural.

2.6 CEILING EXPANSION JOINT COVERS

A. Surface Mount Glide-Plate System: Assembly consisting of center plate that slides in and out of slots in metal frames fixed to sides of joint gap.

1. Basis-of-Design Product: Subject to compliance with requirements, provide #300-A07-100 (4") Glide Plate Ceiling/Ceiling System, 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
2. Manufacturers: Subject to compliance with requirements, undefined:
   a. Balco; a CSW Industrials Company.
   b. inpro Corporation.
   c. MM Systems Corporation.
   d. Nystrom, Inc.
3. Application: Ceiling to ceiling.
4. Fire-Resistance Rating: Not less than **2 hours**.
5. Exposed Metal:
   a. Aluminum: Clar Anodized Class II finish.
      1) Color: Natural.

2.7 MATERIALS

A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

2.8 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, or thicker.

C. Color Anodic Finish: AAMA 611, or thicker.

2.9 ACCESSORIES

A. Manufacturer's standard stainless steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

B. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Fireline F140 Series 2-hour Fire Rated Blanket System, 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. Fireline F140 Series-
        1) 2-hour Fire Rated Blanket systems for small joint openings with 50%+- movement for seismic applications on joints 2- 4” [50- 100mm] nominal width.
        2) Pre-attached flanges and male/female seam configuration.
        3) Compression installation spring system for noninvasive installation.
        4) Prefabricated male/ female seam configuration required for consistent fire protection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
2. Install frames in continuous contact with adjacent surfaces.
    a. Shimming is not permitted.

3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

D. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

E. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 07 95 13.13

SECTION 07 95 13.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior expansion joint covers.

B. Related Requirements:

1. Related work includes but is not limited to:
   a. Concrete Unit Masonry: Section 04 22 00.
   b. Structural Steel: Section 05 1 00.
   c. Polyvinyl-Chloride (PVC) Roofing: Section 07 54 19.
   d. Sheet Metal Flashing and Trim: Section 07 62 00.
   e. Joint Sealants: Section 07 92 00

1.2 REFERENCES

A. Work shall be performed following applicable Local, State, and Federal codes and regulations.

B. Publications listed herein are part of this specification. See below for standards where applicable to the product listed:

1. American Society for Testing and Materials (ASTM):
   a. ASTM B221, “Standard Specifications for Aluminum and Aluminum-Alloy Extrusions.”
   b. ASTM B209, “Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
   c. ASTM E1399 “Cyclic Movement and Measuring of Minimum/Maximum Joint Widths of Architectural Joint Systems.” IPC.3087/Rev.6
   d. ANSI/U.L. No. 263, UL2079, ULCS115, EN1366-4 Fire Rated Testing fort full rated period. Underwriter’s Laboratories shall classify adjacent substrate assemblies.

A. ASTM E1612, Standard Specification for Preformed Architectural Compression Seals for Buildings and Parking Structures.

B. DEFINITIONS

1. Product Movement capabilities
   a. Product operating range defined as a percentage of the nominal joint width.
2. Industry standard requirements: 25%+- operating range for thermal conditions. 50%+- operating range for seismic and windsway conditions.
3. Lateral shear capable systems allow for movement parallel to joint orientation.

1.3 SYSTEM DESCRIPTION

A. Joint coverplate systems shall permit daily thermal expansion and contraction of building elements, minor foundation settlement, and common windsway movements of the structure without disengagement.

1. Joint system details shall clearly indicate X-axis joint movement capabilities (horizontal contraction/ expansion). Y-axis joint movement (in-plane shear), and Zaxis movement (vertical shear) may be requested of the Manufacturer if applicable.

2. Movement capabilities shall be clearly defined as a percentage of the nominal joint width or with distinct dimensions defined on product details.

B. Joint Systems shall allow for seismic movement (if applicable), matching requirements as defined within the Project Specific Structural Specifications.

C. Fire Rated Assemblies shall be tested by registered Third Party Testing Agencies in accordance with UL2079, ULC S115, or BS 476 classified systems. Expansion joint assembly fire rating shall match or exceed the fire rating of adjacent construction.

1.4 QUALITY ASSURANCE

A. Architectural Joint Cover Manufacturer: Furnish horizontal and vertical systems from a Manufacturer with a minimum of ten (10) years of experience in the design, engineering and fabrication of expansion joint systems.

B. Fire Rated Assembly Manufacturer: Furnish horizontal and vertical rated systems from a single Manufacturer to ensure compatibility. Intersection of/ or transition between dissimilar systems is not allowed unless reviewed and approved by AHJ.

C. Installer: Contractor with not less than three (3) years of successful experience in the installation of systems similar to those required by Project.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer’s Specifications, technical data, installation instructions, and detail drawings for each proposed system.

2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

a. Exterior expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each exposed expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

D. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion joint cover assembly.
2. Expansion joint cover assembly location cross-referenced to Drawings.
3. Nominal, minimum, and maximum joint width.
4. Movement direction.
5. Materials, colors, and finishes.
6. Product options.
7. Fire-resistance ratings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY AND STORAGE

A. Manufacturer to provide protective film on all exposed cover plate components.

B. Deliver joint systems to jobsite in new, clean, unopened cartons or crates of sufficient size and strength to protect materials during transit.

C. Inspect materials upon arrival. Store components in original containers in a clean, dry location. Ensure temperature or moisture sensitive components are stored in a tempered location.

D. Contractor to provide temporary protective covers on all installed finished surfaces. Protection is required to guard against both surface abrasions as well as overloading of horizontal deck components by construction traffic.

1.8 SEQUENCING

A. Submittals shall be completed and remitted to the Project Architect within 4 weeks after award of subcontract.

B. Subcontract for the work of this section shall be planned to allow sufficient time for Manufacturer’s production and delivery scheduling.

1.9 WARRANTY

A. Standard limited warranty against material and manufacturing defects for a period of not less than five (5) years when installed in accordance with Manufacturer’s recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer must be capable of providing a full range Interior and Exterior Architectural Joint Cover systems as well as a full complement of expansion joint accessories.

B. Manufacturer must be capable of providing project specific details accurate to the building construction type.

2.2 MATERIALS

A. Aluminum: Alloy types of 6061-T6, 6063-T6, 6005A, or 5052-H32 sheet goods

1. Floor systems: Mill finish standard.

2. Walls and Ceilings: Standard Class II Clear Anodized.

B. Stainless Steel: Alloy Type 304 for plates and strips.

1. Brushed #4 surface finish standard.

C. Elastomeric Seals: Synthetic rubber seals comprised of a dual extrusion Santoprene rubber for heat welding of all transitions and seams for a monolithic, weathertight installation. EPDM and Neoprene substitutions are not allowed due to their lack of ability to meet this specific requirement.

1. All Santoprene seals must be certified as low VOC as certified by UL Environmental GreenGuard Gold Certification

D. Horizontal and Vertical Moisture Barrier (optional accessory): Min. 45 mil thick fabric reinforced EPDM with optional watertight drain assemblies.

E. Horizontal and Vertical Insulated Moisture Barrier (optional accessory):

1. Min. R Value of 15

2. Must meet ASTM E1399 Cyclic movement requirements matching movement requirements specific to project.

2.3 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to ASCE/SE 7.

B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency.

1. Hose Stream Test: Wall-to-wall and wall-to-soffit assemblies shall be subjected to hose stream testing.

C. Expansion Joint Design Criteria:

1. Seismic Movement:
   a. Joint Movement:
      1) At or above second floor level: 2” relative movement.
      2) At or near the roof level: 4” relative movement

2.5 EXTERIOR EXPANSION JOINT COVERS

A. Exterior Pleated Seal System: Assembly consisting of elastomeric seal anchored to surface-mounted frames fixed to sides of joint gap.

1. Basis-of-Design Product: Subject to compliance with requirements, provide #615-A09-050 Recessed/Flush System, 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. Exterior Pleated Seal system
      1) Standard Nominal Joint applications 2-24” [50-600mm]
      2) Joint operating range 50%+- of total nominal joint width
      3) Integral flexible moisture barrier membrane. 2 ply reinforced EPDM 45 mil thick membrane with nylon mesh reinforcing element.
      4) Pleated Santoprene Seal traits:
         a) Overall seal bellows depth requires 5/8” [15.875 mm]. in order to maintain inherent stability and linear lines after installation
         b) Seal Wall thickness not less than 1/8” [3.175 mm] for high abrasion resistance.
         c) Seal durometer of 70 shore A
         d) No EPDM or Neoprene substitutions allowed.
         e) Manufacturer must carry a color range of a minimum of (6) six standard color options. Custom seal colors must be available upon request.
2. Manufacturers: Subject to compliance with requirements, products by one of, but not limited to, the following:
   a. Balco; a CSW Industrials Company.
   b. inpro Corporation.
   c. Nystrom, Inc.
   d. EMSEAL: a Sika Corporation
3. Application: Wall to wall.
4. Installation: Recessed.
5. Fire-Resistance Rating: Not less than 2 hours.
6. Seal: Preformed elastomeric membrane or extrusion.
   a. Color: As selected by Architect from manufacturer's full range.

2.6 MATERIALS

A. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

B. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

2.7 ACCESSORIES

A. Manufacturer's stainless steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

B. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Fireline F140 Series 2-hour Fire Rated Blanket System, 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. Fireline F140 Series-
1) 2-hour Fire Rated Blanket systems for small joint openings with 50%+- movement for seismic applications on joints 2- 4” [50- 100mm] nominal width.
2) Pre-attached flanges and male/female seam configuration.
3) Compression installation spring system for noninvasive installation.
4) Prefabricated male/ female seam configuration required for consistent fire protection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Install frames in continuous contact with adjacent surfaces.
   a. Shimming is not permitted.
5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Elastomeric Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Preformed Foam Joint Seals: Install in compliance with manufacturer's written instructions. Install with minimum number of end joints.

1. Install each length of seal immediately after removing protective wrapping.
2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

E. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

G. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections.

END OF SECTION 07 95 13.16

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.
2. Exterior standard steel frames.

B.

C. 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.
4. Section 08 88 53 - “Security Glazing” for security 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. 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 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.

2.5 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

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.

2.6 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.

2.7 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.

2.8 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. 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.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. 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.

F. 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.

2.9 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.

2.10 ACCESSORIES

A. Louvers: Provide galvanized louvers with insect screen for exterior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.0200-inch thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.

1. Sight proof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.

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.

C. 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.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

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 11 16 - FIRE-RATED ALUMINUM FRAMES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire-rated aluminum door frames.

1.02 RELATED SECTIONS

A. Section 08 14 16- Flush Wood Doors
B. Section 08 71 00 - Door Hardware.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
   2. ASTM E2074 Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.

B. National Fire Protection Association (NFPA):
   1. NFPA 80: Standard for Fire Doors and Fire Windows.
   2. NFPA 251: Standard Methods of Tests of Fire Endurance of Building Construction and Materials.
   3. NFPA 252: Standard Methods of Fire Tests of Door Assemblies.

C. Uniform Building Code (UBC):
   1. UBC-7-2: Methods for Fire Tests of Door Assemblies.

D. Underwriters Laboratories, Inc. (UL):
   1. UL 10C: Positive Pressure Fire Tests of Door Assemblies.

E. Standard Council of Canada:
   1. ULC Standard CAN4-S104: Fire Tests of Door Assemblies.

F. American National Standards Institute (ANSI):
   1. ANSI Z97.1 Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.

G. Consumer Product Safety Commission (CPSC):
   1. CPSC 16 CFR 1201 Categories I and II: Safety Standard for Glazing Materials.

1.04 SYSTEM DESCRIPTION

A. Performance Requirements:

   1. Fire Rating: 90 minutes.
   2. Certification: Doors and frames shall be tested in accordance with ASTM E 2074, NFPA 252, UBC 7-2, UL 10C, CAN4-S104.
   3. Testing Laboratory: Fire tests shall be conducted by an approved independent testing laboratory, similar to Underwriter’s Laboratories, Inc.

1.05 SUBMITTALS

A. Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedure Section.
   1. Shop Drawings: Submit shop drawings showing layouts, profiles and product components.
   2. Samples: Submit samples for finishes, colors and textures.
   3. Technical Information: Submit latest edition of manufacturer's product data providing product description, technical data and installation instructions.

1.05 QUALITY ASSURANCE

A. Listings and Labels:
Fire rated framing shall be under current follow-up services by an approved independent agency and maintain a current listing or certification. Assemblies shall be labeled in accordance with limits of listings.

1.07 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Delivery: Deliver materials to specified destination in manufacturer's packaging undamaged, complete with installation instructions.

C. Storage and Protection: Store off ground, under cover, protected from weather, direct sunlight, construction activities and at temperature conditions recommended by manufacturer, +10°F to +110°F.

D. Handling: Protect materials and finish during handling and installation to prevent damage.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements for openings by field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

PART 2 - PRODUCTS

2.01 FIRE-RATED ALUMINUM FRAMES

A. Manufacturer: Subject to compliance with requirements.

B. Basis-of-Design Product: Aluflam North America
   1. Contact: 16604 Edwards Road, Cerritos, CA 90703: Telephone 562.926.9520 Fax 562.404.1394. E-mail info@aluflam-usa.com Website www.aluflam-usa.com, or local representative (www.aluflam-usa.com/contact/representatives.php).

2.02 MATERIALS – ALUMINUM FRAMING

A. Frame construction: Integral structure from extruded and thermally broken aluminum profiles. Filled internally with cement composite material.

B. Assembly: Frame corners assembled by means of crimped and bonded miter joints.

C. Sealing: Framing system shall insulate against effects of fire, smoke, and heat transfer from either side. Perimeter of the framing system to the rough opening shall be firmly packed with

mineral wool insulation.

2.03 FABRICATION

A. Door frames shall be furnished pre-assembled.

B. Fabrication Dimensions: Fabricate to approved dimensions. The general contractor shall guarantee dimensions within required tolerance (+ - 1/8”). Obtain approved shop drawings prior to fabrication.

2.04 FINISHES

A. Framing shall be chemically cleaned and pretreated, then finished on all exposed areas with: Anodized – Clear finish.

B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Slight variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

C. Examine area to receive frames. Openings shall be plumb, square and within allowable tolerances. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Frame installation shall be by a specialty contractor with appropriate experience qualifications, and in strict accordance with the approved shop drawings.

3.03 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Frame should be cleaned using soft, clean cloth, chamois leathers, sponges or soft paper. Use clean warm water with a mild detergent. Do not use detergent that contains either alkaline, acids or fluoride! Abrasive cleaning methods can damage surfaces! Clean prior to owner’s acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 08 11 16

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.

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.

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

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 & Bullet Resistant Fiberglass reinforced polyester (BRP) flush doors.
2. Section 08 80 00 - "Glazing" for glass view panels in Fiberglass reinforced polyester (FRP) flush doors.
3. Section 08 88 53 - “Security Glazing” for security glazing in Bullet Resistant Fiberglass reinforced polyester (BRP) 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.

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 088000 “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

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 33 13 - COILING COUNTER 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. Coiling Counter doors with Electric Door Operator.

B. Related Requirements:

1. Section 05 50 00 - "Metal Fabrications" for miscellaneous steel supports. Door opening jamb and head members.
2. Section 08 70 00 - Door Hardware
3. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, and installation of control station and wiring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, and other accessories.
5. Include diagrams for power, signal, and control wiring.

C. Quality Assurance/Control Submittals:

1. Provide manufacturer ISO 9001:2015 registration.
2. Provide manufacturer and installer qualifications - see below.
3. Provide manufacturer's installation instructions.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.
2. Bottom bar with sensor edge.
3. Guides.
4. Brackets.
5. Hood.
6. Locking device(s) keyed per Specification Section 087100.
7. Include similar Samples of accessories involving color selection.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manual

B. Certificate stating that installed materials comply with this specification.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship

B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.

1. Obtain operators and controls from coiling counter door manufacturer.

2.2 Manufacturer:

A. Basis-of-Design Product: Subject to compliance with requirements, provide Model ESC10 Type 6DMI Tube Motor Operated Coiling Counter Door by Cornell Cookson or approved equal.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

2.3 MATERIALS

A. Curtain:

1. Slat Configuration:
   a. Stainless Steel: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 22-gauge AISI type 304 #4 finish stainless steel with stainless steel angle bottom bar with lift handles and vinyl astragal

2. Finish:
   a. Stainless Steel: type 304 #4 finish

B. Endlocks:

1. Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats

C. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

1. Fabrication:
   a. Stainless Steel: 12 gauge formed shapes

2. Finish:
   a. Stainless Steel: type 304 #4 finish

D. Shaft Assembly:

1. Tube Motor Shaft Assembly:
   a. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width

E. Brackets:
Fabricate from reinforced steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures.

1. Finish:
   a. Standard (Stock Colors): Zirconium treatment followed by a [gray] [tan] [white] baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.

2.4 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Stainless Steel: 0.025-inch- thick, stainless steel sheet, Type 304, complying with ASTM A240/A240M or ASTM A666.

2.5 OPERATION

1. Electric Tube Motor Operator: Rated for a maximum of 10 cycles per day, cULus recognized, rated (50nm) (100nm) or (200nm) as recommended by door manufacturer for size and type of door, 110 Volts, 1 Phase. Provide complete with electric tube motor, maintenance free electric brake, emergency manual crank hoist and control station(s).

Motor shall be protected against overload with an auto-reset thermal sensing device. Operator shall be equipped with an emergency manual crank hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual crank hoist. Operator shall be capable of 10-14 RPM. Fully adjustable, mechanical internal worm limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.

2. Control Station: For use with motor operated units only
   a. (Tube Motor Only): Flush mounted: Rocker Switch; NEMA 1

3. Control Operation:
   a. Constant pressure to close:
   b. No sensing device required

2.5 ACCESSORIES

A. Locking Devices: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: Cylinders specified in Section 08 71 00 "Door Hardware".

2. Keys: Three for each cylinder.

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

C. Operator and Bracket Mechanism Cover: Minimum 24-gauge stainless steel sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood.

D. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" 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.

2.7 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 13

SECTION 08 36 13 - SECTIONAL 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 electrically operated sectional doors.

B. Related Requirements:

1. Section 05 50 00 - "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Coordinate locations, clearances and dimensions of components with other trades, including, but not limited to, HVAC, structural steel, and electrical.
4. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Flat door sections with sensor edge on bottom section.
2. Frame for paneled door sections; of each width of stile and rail required.
3. Panel for raised-panel door sections; not smaller than required to show raised-panel profile.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with applicable provisions in "Uniform Federal Accessibility Standards" ICC A117.1.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors 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. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
e. Delamination of exterior or interior facing materials.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.

C. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5.

2.3 DOOR ASSEMBLY

A. Full-Vision Aluminum Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.

D. Installed R-Value: 12.0 deg F x h x sq. ft./Btu.

E. Aluminum Sections: Full vision.

F. Track Configuration: Vertical-lift track.

G. Roller-Tire Material: Manufacturer's standard.

H. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: Cremone type, both jamb sides, locking bars, operable from outside with cylinder.

I. Counterbalance Type: Torsion spring.

J. Electric Door Operator:

1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
2. Operator Type: Jackshaft, side mounted.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Interior, clean, and dry.
5. Obstruction-Detection Device: Automatic; self-monitoring type.
6. Control Station: Provide ‘keyed control’ device for safety.

K. Door Finish:

1. Aluminum Finish: Clear anodized.

2.4 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 ALUMINUM DOOR SECTIONS

A. Sections: Extruded-aluminum stile and rail members with dimensions and profiles as indicated on Drawings; members joined by welding or with concealed, 1/4-inch-minimum diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section; and with meeting rails shaped to provide a weather-resistant seal.

1. Aluminum: ASTM B 221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; minimum thickness 0.065 inch for door section 1-3/4 inches deep, and as required to comply with requirements.
2. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
3. Provide reinforcement for hardware attachment.

B. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section fully glazed with glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops. See drawings for glazing type.

2.6 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.

1. Galvanized Steel: ASTM A 653/A 653M, minimum G60 zinc coating.
2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

    a. For Vertical Track: Continuous reinforcing angle attached to track and attached to wall with jamb brackets.
    b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

2.7 HARDWARE

A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch-nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet wide unless otherwise recommended by door manufacturer.

C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch-wide track and 2-inch-diameter roller tires for 2-inch-wide track.

D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.8 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: Cylinders specified in Section 08 71 00 "Door Hardware".
2. Keys: Three for each cylinder.

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.9 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

B. Weight Counterbalance: Counterbalance mechanism consisting of filled pipe weights that move vertically in a galvanized-steel weight pipe. Connect pipe weights with cable to weight-cable drums mounted on torsion shaft made of steel tube or solid steel.

C. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.

D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.

E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.10 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.

1. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.

1. Electrical Characteristics:

a. Phase: Single phase.
b. Volts: 115 V.
c. Hertz: 60.

2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
5. Use adjustable motor-mounting bases for belt-driven operators.

E. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom section. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Self-Monitoring Type: Four-wire configured device designed to interface with door-operator control circuit to detect damage to or disconnection of sensor edge.

G. Control Station: Three-button ‘keyed for safety’ control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure, push-button control labeled "Close." Keyed per Specification 087100.

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf**.**

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount

mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" 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.

2.12 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 08 36 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.
3. Louvers in Storefront Framing

B. Related Requirements:

1. Section 01 43 39 – “Classroom Mockup”.
2. Section 07 92 00 - “Joint Sealants”.
3. Sections 08 14 16 - “Flush Wood Doors” and 081743 “Flush FRP Doors” for doors in Aluminum-Framed Storefronts.
4. Section 08 71 00 - "Door Hardware" for door hardware for doors in Aluminum-Framed Storefronts.
5. Section 08 91 19 - “Fixed Louvers” for louvers installed in CMU walls.
6. Section 08 51 13 - "Aluminum Windows" for windows installed in Aluminum-Framed Storefronts.
7. 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.

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.

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" and 08 88 53 – “Security 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. Blade Type: Vision-proof, inverted V or Y.
3. Thickness: 1 inch to fit glazing pocket of framing system.
4. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
5. Provide screen at each exterior louver.
6. 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 01 43 39 – “Classroom Mockup”.
2. Section 07 92 00 - “Joint Sealants”.
3. Section 08 41 13 - “Aluminum-Framed Entrances and Storefronts” for frames where Aluminum Windows occur.
4. Section 08 80 00 - “Glazing” for additional glazing requirements for Aluminum Windows.
5. 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 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 014339 – 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.

1.10 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 Types B9, B10, B11 & B12.

4. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

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: 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 56 53 – TRANSACTION SECURITY 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:

1. Fixed, transaction security window at main entrance. Includes transaction security windows, deal trays, package passer and voice amplification.

B. Related Requirements:

1. Section 06 41 16 - “Plastic-Laminate-Faced Architectural Cabinets for solid surface counter at transaction window.
2. Section 08 88 53 - "Security Glazing" for ballistically rated security glazing.

1.3 COORDINATION

A. Coordinate installation of anchorages for security windows. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in adjacent construction. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, weights and finishes for window units.

B. Shop Drawings: For security windows.

1. Include plans, elevations, sections, and attachment details.
2. Full-size section details of framing members, including internal armoring, reinforcement, and stiffeners.
3. Glazing details.
4. Details of deal tray and speaking aperture.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:

1. Framing: 12-inch- long sections of frame members.
2. Transaction Drawer: 6 inches square.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of security window and accessory indicated as ballistics resistant, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For cleaning instruction for transaction security windows.

1.7 QUALITY ASSURANCE

1.8 DELIVERY, STORAGE, AND HANDLING

A. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.

B. Label security window packaging with drawing designation.

C. Store crated security windows on raised blocks to prevent moisture damage.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.10 SEQUENCING

A. Field Painting: Except where security windows have been pre-glazed before installation, complete field painting of security windows before glazing installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Attack Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:

1. Ballistics Resistance: Listed and labeled as Level 3 when tested according to UL 752.

2.2 FIXED, TRANSACTION SECURITY WINDOWS

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. Total Security Solutions; Arched Transaction Window, 1 3/16" LP Laminated TSS003 LS or equal.
2. Ballistic Resistance: Level 3 according to UL 752.

3. Maximum Overall Unit Thickness: 1 3/16 inch.
4. 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

5. Framing System: TSS BL3-2.5
   a. 2-1/2” Glazing Channel System
   b. U.L. listed level 3
   c. Clear Anodized Aluminum extrusions
   d. Install per Manufacturer’s written instructions.

5. Provide safety glazing labeling.

2.3 BULLET RESISTANT DEAL TRAYS

A. One-way Non-Ricochet Deal Tray with ‘S’ shaped section on the operator’s side. Creative Industries Level III Bullet Resistant Deal Tray Model 1212 -OW or equal.
   1. Construction: Stainless Steel
   2. Size 12” x 12” by 2”
   3. Bullet Resistance Rated: Level III

2.4 BULLET RESISTENT ACRYLIC PACKAGE PASSER

A. Basis-of-Design Product: Subject to compliance with requirements, provide a product by Total Security Solutions, Inc, 170 National Park Drive, Fowlerville, MI 48836, 800-513-1468, or a comparable product by another manufacturer.

B. Package Passer shall be compatible with the transaction window glazing system.

C. Design Performance

   1. Through the design, manufacturing techniques and material application the Acrylic Package Passer shall be constructed of acrylic with a UL Standard 752 Level 3 rating. This assembly shall provide single or multiple transaction positions utilizing the rectangular acrylic box. The mechanical interlocking mechanism shall prevent the doors from being opened simultaneously, allowing packages to be passed through a barrier without a breach of security. Anchor screws shall be provided by the installer.

   2. No field alterations to the construction of the units fabricated under the acceptable standards shall be allowed unless approved by the manufacturer and the architect. Standard manufacturing tolerances shall be +/- 1/16".

   3. Materials shall meet or exceed UL 752 requirements.

D. The package passer consists of a rectangular box built from transparent bullet resistant glazing material, with doors on the customer and employee sides. A mechanical interlocking mechanism hinged door control, prevents the opening of both doors simultaneously, allowing

small packages to be passed through a barrier without a breach of security. Standard base is particle board with black plastic laminate covering, using ¼-20 steel machine screws.

E. Product size shall be OD 16” W x 16” H x 16” D.

F. Security Level shall be Bullet Resistant Level 3, 1-1/4” LP 1250 Laminated.

2.5 VOICE AMPLIFICATION

A. Two-way communications system at Transaction Window.

B. Basis-of-Design Product: Subject to compliance with requirements, provide the SC-300 by Haven Technology Corporation, 4130 Flat Rock Drive, Riverside CA 92505, (888) 853-4643, info@haventech.com , or a comparable product by another manufacturer.

1. Product shall provide electronic two-way, hands-free audio communication between partition (window). Voice amplification system shall include:
    a. 20” gooseneck microphone on master unit.
    b. Factory-adjusted VOX switch to prevent ambient noise (below 85 decibels) from activating the unit.
    c. Two voice channels, each incorporating a microphone amplifier.
    d. VOX switch, compressor, and power amplifier.
        1) The sound amplifier shall not exceed a 0.2% total harmonic distortion rating.
    e. AC/DC power supply.
    f. 1- year minimum warranty.
2. Attach units to counter. Coordinate final location with Owner.
3. Secure cable to underside of counter on Vestibule side. Coordinate routing with electrical.

2.6 FABRICATION

A. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.

1. Provide units that are reglazable from the secure side without dismantling the attack side of framing.
2. Prepare security windows for field glazing unless preglazing at the factory is indicated.

B. Provide weep holes and internal water passages for exterior security windows to conduct infiltrating water to the exterior.

C. Thermally Improved or Thermally Broken Construction: Fabricate framing with an integral, concealed, low-conductance thermal barrier, located between exterior materials and members exposed on interior in a manner that eliminates direct metal-to-metal contact.

D. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.

1. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.

E. Glazing Stops: Finish glazing stops to match security window framing.

1. Attack-Side (Exterior) Glazing Stops: Welded or integral to framing.
2. Secure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.

F. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

G. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

H. Factory-cut openings in glazing for speaking apertures.

I. Weather Stripping: Factory applied.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 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.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.9 ACCESSORIES

A. Speaking Apertures: Fabricate from security glazing, designed to allow passage of speech at normal speaking volume without distortion.

1. Shape: Circular.
2. Ballistics Resistance: UL Level 3.
3. Listed and labeled as bullet resisting according to UL 752.

B. Glazing Strips and Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Molded EPDM or neoprene gaskets complying with ASTM D 2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D 2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric backing.

C. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers and with a proven record of compatibility with surfaces contacted in installation.

1. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
2. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

3. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

D. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B 633; provide sufficient strength to withstand design pressures indicated.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating.

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 security windows.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before security window installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of security windows.

D. Inspect built-in and cast-in anchor installations, before installing security windows, to verify that anchor installations comply with requirements. Prepare inspection reports.

1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional work. Prepare anchor inspection reports.

E. For factory-installed glazing materials whose orientation (secure or attack side) is critical for performance, verify installation orientation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other security window anchors whose installation is specified in other Sections.

1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

3.3 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.

1. Install an attached or integral flange to secure side of security windows extending over rough-in opening gap so that gap has same ballistics-resistance performance as security window.

B. Voice-Communication-Type Framing: Attach removable glass spacers to jambs and head of glazing, located not more than 6 inches from each corner and spaced not more than 12 inches o.c.

C. Glazed Framing: Provide gasket-glazed framing. Comply with installation requirements in Section 088853 "Security Glazing."

D. Removable Glazing Stops and Trim: Fasten components with security fasteners.

E. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials.

F. Sealants: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.

1. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction unless otherwise indicated.
2. Seal frame perimeter with sealant to provide weathertight construction unless otherwise indicated.

G. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.4 ADJUSTING

A. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.

B. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

3.5 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.

B. Clean glass of preglazed security windows promptly after installation. Comply with requirements in Section 08 88 53 "Security Glazing" for cleaning and maintenance.

C. Provide temporary protection to ensure that security windows are without damage at time of Substantial Completion.

END OF SECTION 08 56 53

SECTION 08 62 23 – TUBULAR DAYLIGHTING DEVICES

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. Tubular daylighting devices and accessories.

B. Related requirements:
1. Section 07 54 19 - “PVC Roofing” for roofing membrane.
2. Section 07 71 00 - “Roof Specialties”.
3. Section 07 72 00 - “Roof Accessories”.
4. Section 07 92 00 - “Joint Sealants”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of tubular daylighting device.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for tubular daylighting devices.
2. Include power requirements, ratings, characteristics, and mounting requirements for electrical components.

B. Shop Drawings: For unit tubular daylighting device work.

1. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.
2. Multiple Units: Methods of connection and structural support for multiple units clustered together.
3. Include diagrams for power, signal, and control wiring.
4. Coordinate drawings with other trades suspended from ceiling deck.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type and size of tubular daylighting device, for tests performed within the last four years by a qualified testing agency.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating tubular daylighting devices that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to tubular daylighting device manufacturer for installation of units required for this Project.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tubular daylighting devices that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Uncontrolled water leakage.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Yellowing of acrylic glazing.
d. Breakage of polycarbonate glazing.

2. Warranty Period: Ten years from date of Substantial Completion.

3. Electrical Parts: Manufacturer's standard warranty for 5 years, unless otherwise indicated.

4. LED Emitters, Drivers and Controls: Manufacturer’s standard warranty for 3 years against failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Solatube International, Inc.; 2210 Oak Ridge Way, Vista, CA 92081. Tel. Toll Free: 888-765-2882. Tel: (760) 477-1120. Fax: (760) 597-4488. Email: commsales@solatube.com. Web: www.solatube.com.

B. Basis-of-Design Product: Subject to compliance with requirements, provide SOLATUBE Skyvault M74 DS, or comparable product.

C. Requests for substitutions will be considered in accordance with the provisions of Section 01600.

2.2 TUBULAR DAYLIGHTING DEVICES

A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

B. SkyVault Series: Solatube Model M74 DS, 28.5-inch (724 mm) Daylighting System:
   1. Model:
      a. Solatube Model M74 DS - O Open Ceiling. AAMA Type TDDOC.
      b. Domes:
         1) Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
            (a) Fasteners: Non-corrosive metal fasteners including non-magnetic stainless steel, zinc plated steel, aluminum, or injection molded nylon.
            (b) Dome Edge Protection Band: For Classified Roof Assemblies. For approved assemblies, curb height (by others or built on site) must be more than 8 inches (203 mm). Galvanized steel. Nominal thickness of 0.039 inch (1 mm).
         2) Dual Dome Glazing: Type DPP.
            (a) Outer Dome Glazing: 0.125 inch (3.2 mm) minimum thickness, vacuum formed polycarbonate classified as CC1 material; UV inhibiting; (100 percent UVC, 100 percent UVB and 98.8 percent of the range of UVA transmission).
            (b) Inner Dome Glazing: 0.040-inch (1 mm) minimum thickness, copolyester (PETG) polyethylene terephthalate with glycol classified as CC2 material.
            (c) Seals:
               (1) Inner Dome Seal: Adhesive back closed cell foam seal 0.125 inch (3.2 mm) or 0.188 inch (4.8 mm) tall by 0.375 inch (9.5 mm) wide.
               (2) Dome Assembly Seal: Adhesive backed pile weather-strip, 0.350 inch (8.9 mm) tall by 0.187 inch (4.8 mm) wide.
      c. Dome Options:
         1) Security Guard: Type SG, welded powder coated steel or stainless-steel rods 1/8-inch diameter mounted with an 8-inch maximum cross section. Assembly fastened with 1/8-inch diameter blind rivets in 6 locations to Curb-Cap assembly.
         2) Security Kit: Type SK Dome Security Kit, rivets with nylon spacers to replace dome screws
      d. Flashings:
         1) Curb Cap Flashing Base (used for interior trim under metal deck as well-see drawings): Type FC one-piece, seamless, leak-proof flashing and base support for dome and top of tube and cap flashing. Fabricated of galvanized steel, conforming to ASTM A 653/A 653M or ASTM A 463/A 463M or ASTM A792/A 792M, with a thickness of 0.0276 inch (0.7 mm) plus or minus .004 inch (.01 mm).
            (a) Base Style: Curb-cap, with inside dimensions of 35.5 inches by 35.5 inches (905 mm by 905 mm) to cover curb specified in Section 07600.
            (b) Insulation: Nominal 1-inch-thick thermal isolation pad to reduce thermal conduction between curb-cap and tubing and thermal convection between room air and curb-cap. Rated R-6 ($^{O}Fxft^{2}xhr/Btu$) Insulation is Polyisocyanurate foam utilizing CFC, HCFC, & HFC free blowing agent. Type-1 Class-1 per ASTM C 1289; Passes UL 1715 (15-minute thermal barrier per IBC 2603.4); Attic ventilation may be required per IBC 1203.2.
            (c) Curb Seal: Includes a double bead of adhesive backed closed cell foam seal 0.188 inch (4.8mm) tall by 0.375 inch (9.5mm) wide to reduce air infiltration.
            (d) Tube Collar: Attached to top of curb-cap section; 0.018-inch (0.45

mm) nominal thickness aluminum conforming to ASTM B 209.
(1) Interior Finish: Spectralight Infinity with Cool Tube Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.

2. Transfer Zone:
   a. Extension Tubes: Aluminum sheet, thickness 0.018 inch (0.5 mm) conforming to ASTM B 209 with Tab-Lock tube joint structural connection system.
      1) Reflective Tubes:
         (a) Reflective 24-inch (610mm) extension tube, Type EXX with total length of run as indicated on the Drawings.
         (b) Belt Alignment Tab aligns Tube Belt on to tube in the correct location.
         (c) Interior Finish: Spectralight Infinity with Cool Tube Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.
      2) Tab-Lock
         (a) Tab-Lock captures adjoining tube or tube connector using periodic opposing hooks integrated in the tube perimeter with mating retention detents.
         (b) Hook system allows ease of tube engagement or disengagement for single operator from man-lift or rooftop.
         (c) System intertwines the ends of the adjoining tubes and tube connectors between each Tab-Lock station.
         (d) Intertwining function accepts tubes and connectors of common diameters that reduces light loss up to 2 percent per tube joint relative to tubes with 0.3-inch (7.6 mm) diameter difference.
      3) Tube Belt:
         (a) Sheet-metal belt 2-inch (50.8 mm) wide by 28.5-inch (724 mm) nominal diameter by 0.022-inch (0.5 mm) thick CS-B AZ-50 ASTM A 792 with 0.10 inch (2.5mm) diameter stainless steel type 302 ASTM A 313 torsion spring actuated toggle clamp.
         (b) Retains Tab-Lock tube joint structural connection system; stiffens linear tube assembly; and prevents tube rotation or disengagement under normal use.
         (c) Includes locking tab to prevent unintentional Tube Belt Latch opening due to handling, service, vibration, or normal operation or use.
      4) Extension Tube Options
         (a) Reflective 48-inch extension tube, Type EL 48 inches (1220 mm) long. Use to replace two standard 24-inch (610 mm) extension tubes when long tube runs are required.
         (b) Trim Ring: Type R. Provides a finished appearance to the installation, covering the cut edge of the roof deck penetration in an open ceiling application.
         (c) Thermal Insulation Panel with Integral 24 inches (610 mm) Extension Tube: Type TIP, high-performance dual-glazed, thermally-broken tube insulation system consisting of two acrylic panels, spaced 1.0 inch (25.4 mm) apart, classified CC2 Class C material, 0.110 inch (2.8 mm) thick, housed in a polyethylene terephthalate glycol-modified (PETG) or acrylonitrile butadiene styrene (ABS) band classified as CC2 material 0.060 inch (1.5 mm) thick by 1.75 inch (44.5 mm) high with Spectralight Infinity high reflectance specular finish interior surface, and assembled with stainless steel disk spacers 0.0197 inch (0.5 mm) thick and aluminum rivets 0.13 inch (3.2 mm) fastened periodically around

the perimeter. Dual-glazed Panel assembly integrated with a 12 inch Upper and a 12-inch Lower Transition Tube made of Spectralight Infinity with Cool Tube Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance to form a nominal 24.9 inch (633mm) tube assembly with integrated Tab-Lock connections.

3. Delivery Zone:
   a. Daylight Dimmer - 0 to 10 V Dimmer Control: Provide electrical actuator controller, auxiliary switch(s), and cable as specified in Section 25 50 00; Common Work Results Electrical Section 26 05 00; and Lighting Equipment and Controls Section 26 50 00.
      1) Low Voltage Daylight Dimmer, Type D1, is an Electro-mechanically actuated daylight valve; 0-10 V Control, Class-2, UL Listed. Low voltage Daylight Dimmer, an electrical actuator provides for programmable (0 to 10VDC) scene-based dimming control for daylight output between 0.5 and 100 percent, auxiliary 12VDC dimming control for daylight output between 2 and 100 percent, or auxiliary ON/OFF control. Input voltage: 24VAC at 50 or 60 Hz. Daylight Dimmer assembly integrated with a 12 inch Upper and a 12-inch Lower Transition Tube made of Spectralight Infinity with Cool Tube Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance to form a nominal 24.9 inch (633mm) tube assembly with integrated Tab-Lock connections.
         (a) Programmable (0 to 10VDC) Control: requires an electrical actuator lighting controller or building automation controller capable of producing a signal between 0 and +10 VDC (Min 50mA) to incrementally modulate up to 50 daisy chained Daylight Dimmers (Current Sinking) between fully closed at 0 to 1 volts to fully open at 9 to 10 volts.
         (b) Requires CL-2 (Min), 18 AWG, stranded copper, two conductor, twisted cable from lighting controller to first dimmer and interconnecting between subsequent dimmers.
         (c) Auxiliary 12VDC Dimming Control requires 12VDC Dimming Switch (Current Sourcing; 12VDC power supply not required).
            (1) 12VDC dimming control requires CL-2 (Min), 22 AWG, stranded, three conductor, twisted cable from switch to first dimmer and CL-2 (Min), 18 AWG, stranded copper, two conductor, twisted cable; interconnecting subsequent dimmers.
         (d) Auxiliary ON/OFF Control: requires commercial or residential single pole electric light switch.
            (1) ON/OFF control requires CL-2 (Min), 22 AWG, stranded, three conductor, twisted cable from switch to first dimmer and CL-2 (Min), 18 AWG, stranded copper, two conductor, twisted cable; interconnecting subsequent dimmers.
      2) Power can be transformed from line voltage through use of a UL Listed Class-2, 24VAC Transformer.
   b. Bottom Assembly:
      1) Base Diffuser Assemblies for Tubes Not Penetrating Ceilings (Open Ceiling): Type B, Solatube Model M74 DS-O. 28.5-inch (724 mm) diameter diffuser attached directly to bottom of tube.
         (a) Diffuser Collar: Attached to diffuser lens; 0.018-inch (0.45 mm) nominal thickness aluminum.
            (1) Interior Finish: Spectralight Infinity with Cool Tube Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.

(2) Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.

(b) Diffuser Belt:

(1) Sheet-metal belt 2-inch (50.8 mm) wide by 28.5 inch (724 mm) nominal diameter by 0.022 inch (0.5 mm) thick CS-B AZ-50 ASTM A792 with 0.10 inch (2.5 mm) diameter stainless steel Type 302 ASTM A 313 torsion spring actuated toggle clamp.

(2) Retains Tab-Lock tube joint structural connection system; stiffens linear tube assembly; and prevents tube rotation or disengagement under normal use.

(3) Includes locking tab to prevent unintentional Latch opening due to handling, service, vibration, or normal operation or use.

2) Diffuser Lens:

(a) Lens: Type L2, Prismatic lens designed to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.100 inch (2.5 mm) thick. Classified as CC2.

(b) Diffuser Collar: Attached to diffuser lens; 0.018-inch (0.45 mm) nominal thickness aluminum.

(1) Interior Finish: Spectralight Infinity with Cool Tube Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.

(c) Diffuser Seal: “L” shaped EPDM closed cell foam, 0.86 inch (21.8 mm) wide by 1.37 inch (34.8mm) tall by 0.16 inch (4.1 mm) thick to minimize condensation and bug, dirt, and air infiltration per ASTM E 283.

(d) Diffuser Band: Stainless steel diffuser band, 0.25 inch (6.4 mm) wide by 0.020 inch (0.5 mm) thick stainless-steel Type 201 ASTM A 666, for enhanced seal performance and protection.

2.3 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions.

C. If substrate and rough opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Coordinate requirements for power supply, conduit and wiring.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B. Coordinate installation with substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing to ensure that each element of the Work performs properly, and that finished installation is weather tight.
   1. Install flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.
   2. Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.
   3. Coordinate attachment and seal of perimeter air and vapor barrier material.

C. Install products and accessories to comply with recommendations in AAMA 1607 and with manufacturer's written installation instructions.

D. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, provide permanent separation as recommended by manufacturer

E. Align device free of warp or twist, maintain dimensional tolerances.

F. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

G. Inspect installation to verify secure and proper mounting. Test each fixture to verify operation, control functions, and performance. Correct deficiencies.

3.4 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect product surfaces from contact with contaminating substances resulting from construction operations.

E. Daylight Dimmer Assemblies: Test and adjust dimmer assemblies in tubular daylighting devices for proper operation.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the following:
   1. Operating systems for unit skylights.
   2. Daylight dimmer assemblies for tubular daylighting devices.

END OF SECTION 08 62 23

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. Exterior gates with exit hardware and closers

2. Electrified door hardware.
3. Keyed Cylinders for other door types within project.

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 33 13 - "Coiling Counter Doors" for door hardware provided as part of overhead door assemblies.
5. Section 08 36 13 - "Sectional Doors" for door hardware provided as part of sectional door controls and assemblies.
6. Section 08 41 13 - "Aluminum-Framed Entrances and Storefronts" for installation of entrance door hardware, except cylinders.
7. Section 08 11 16 – “Fire-Rated Aluminum Frames” for installation of door hardware, except cylinders.
8. Section 28 13 00 - "Access Control" for access control devices installed at door openings and provided as part of a security system.
9. Section 28 16 00 - "Intrusion Detection" for detection devices installed at door openings and provided as part of an intrusion-detection system.
10. Section 28 31 11 - "Digital, Addressable Fire-Alarm System" for connections to building fire-alarm 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. Warehousing 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 013100 "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. 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:
3. 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.
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).

2.15 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 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: ANSI/BHMA A156.15, Grade 1; wall-mounted electromagnetic single unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.

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. SARGENT Manufacturing Company; ASSA ABLOY.

2.17 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.

2.18 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.

2.19 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.

2.20 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. Restroom Deadbolt Indicator (RDI)
1) Provide spacers with extended screws at deadbolt indicators.

2.21 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware:

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. Allegion plc.
b. Hager Companies.
c. SARGENT Manufacturing Company; ASSA ABLOY.
d. Securitron Magnalock Corporation; an ASSA ABLOY Group company.

B. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; listed and labeled for use with fire alarm systems.

C. Monitor Strikes: Dustbox monitor for installation under standard strike.

D. Door Position Switches: Magnetically operated reed switch designed for concealed mounting.

E. Door and Frame Transfer Devices: Steel housing for mortise in hinge stile of door, with flexible tube for wiring bundle; accommodating doors that swing open to 120 degrees.

2.22 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.

2.23 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 079200 "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.		

*** REPLACE WALL BUMPER WITH IVES FS18S FLOOR STOP AT THE FOLLOWING DOORS: C101, C102, C103, C104, C105, C106, C107, C108, C109, C110, C111, C112, C113, C114, C145A, C145B, C201, C202, C203, C204, C205, C206, C207, C208, C209, C210, C11, C212, C213, C214, C245A & C245B.**

Door Hardware Set No. 02 – Privacy (Student Toilet Room Doors – non-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	Coat Hook	B-682 Door Mount	Bobrick	626
1	Wall Bumper	WS402CV or 1CV (as req.)	Ives	US26D
1	Adj. Door Bottom	SL-301 (integral)	Special-Lite	
1	Perimeter Gasket	By Storefront Manuf.		
1*	Overhead Door Stop	90 Series w/Dead Stop Templating	Glynn-Johnson	626

*** ONLY AT DOORS C142A, C142B, C242A, C242B**
**** MEDECO S4 CYLINDER**

Door Hardware Set No. 02A – (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-682 Door Mount	Bobrick	626
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. 02B – (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-682 Door Mount	Bobrick	626
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. 02C – Restroom Doors within Classrooms

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Lockset	195AB/G3 Entrance Function	Marks	26D
1	Cylinder	20200V1(S) K 26 9C S	Medeco	US26D
1	Closer	4040XP Rw/PA	LCN	AL-689
1	Wall Bumper	WS402CVX	Ives	US26D
1	Perimeter Gasket	By Storefront Manuf.		

Door Hardware Set No. 03 – Mechanical Closets

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	Kickdown Holder	FS452-4	Ives	US26D
1	Floor Stop	FS18S	Ives	
1	Perimeter Gasket	By Storefront Manuf.		

Door Hardware Set No. 04 – Interior Mechanical Closets – double doors

Qty.	Item	Description	Manufacturer	Finish
2	Cont. Hinge	112HD	Ives	US28
1	Lockset	195F/G3	Marks	26D
1	Cylinder	20200V1(S) K 26 9C S	Medeco	US26D
2	Manual Flush Bolt	F358 (top and bottom)	Ives	US26D
2	Kickdown Holder	FS452-4	Ives	US26D
2	Floor Stop	FS18S	Ives	
1	T Astragal	359A	Pemko	A
1	Perimeter Gasket	By Storefront Manuf.		
1	Dustproof Strike	DP1	Ives	

Door Hardware Set No. 04A – Interior Storage Room – double doors

Qty.	Item	Description	Manufacturer	Finish
2	Cont. Hinge	112HD	Ives	US28
1	Lockset	195F/G3	Marks	26D
1	Cylinder	20200V1(S) K 26 9C S	Medeco	US26D
2	Manual Flush Bolt	F358 (top and bottom)	Ives	US26D
2	Kickdown Holder	FS452-4	Ives	US26D
4	Kick Plate	J1021 12x36	Don-jo	626
2	Floor Stop	FS18S	Ives	
1	T Astragal	359A	Pemko	A
1	Perimeter Gasket	By Storefront Manuf.		
1	Dustproof Strike	DP1	Ives	

Door Hardware Set No. 05 – Entry Office and 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.		

* Floor Stop FS18S (Ives)
At doors A109, A110, A111

Door Hardware Set No. 06 – Interior Storeroom @ Hollow Metal 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
2	Kick Plate	J1021 12x36	Don-jo	626
1	Kickdown Holder	FS452-4	Ives	US26D
1	Perimeter Gasket	S88GR @ HM Frame only	Pemko	GR

Door Hardware Set No. 06A – 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
1	Perimeter Gasket	By Storefront Manuf. @ Alum.	Frame only	
1*	Key Switch & Housing	653-04	Schlage	SF-626

*** ONLY AT DOOR C132**

Door Hardware Set No. 06B – Custodian

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
2	Kick Plate	J1021 12x36	Don-jo	626
1	Perimeter Gasket	By Storefront Manuf. @ Alum.	Frame only	

Door Hardware Set No. 07 – Communicating Classroom

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Lockset	195DC/G3	Marks	26D
2	Cylinder	20200V0(S) K 26 9C S	Medeco	US26D
1	Closer	4040XP Rw/PA	LCN	AL-689
1	Kickdown Holder	FS452-4	Ives	US26D
1	Wall Bumper	WS402CVX	Ives	US26D
1	Perimeter Gasket	By Storefront Manuf.		

Door Hardware Set No. 08 – Interior with Exit Device and Electronic/Magnetic Hold-Open

Qty.	Item	Description	Manufacturer	Finish

2	Cont. Hinge	112HD	Ives	US28
2	Exit Device	CD9927NL 4	Von Duprin	US26D
2	Top Strike	299	Von Duprin	US26
2	Bottom Strike	304L	Von Duprin	
2	Cylinder	33-07603V	Medeco	US26D
2	Closer	4040XP Rw/PA (hinge side)	LCN	AL-689
2	Hold Open	993 High Hold	Rixson	AL-689
1	Meeting Stile	369AP	Pemko	A
1	Perimeter Gasket	By Storefront Manuf.		
2	Wall Bracket	See Detail 17/A708	Custom made	Paint
1	Key Switch & Housing	653-04	Schlage	SF-626

Door Hardware Set No. 09 – Interior with Push/Pulls and Manual Hold-Open (Dual Swing Multipurpose Room)

Qty.	Item	Description	Manufacturer	Finish
2	Cont. Hinge	700	Ives	US32D
2	Closer	4040XP	LCN	AL-689
2	Mag. Hold Open	993 High Hold	Rixson	AL
2	Meeting Stile	Radius	Special-Lite	A
2	Pull/Pushbar	9103EZ	Ives	US26D
1	Perimeter Gasket	By Storefront Manuf.		
3	Key Switches & Housings	653-04	Schlage	SF-626
2**	Mag. Lock	993 High Hold	Rixson	AL-689
2	Wall Bracket	See Detail 17/A708 Sim.	Custom by Door Hardware Supplier	Paint
**	Reinforce Aluminum Storefront Frames and FRP Doors as required.			

Door Hardware Set No. 10 – Interior Exit without Access Control (non latching)

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Closer	4040XP-3077CNS	LCN	AL-689
1	Pull/Pushbar	9103EZ	Ives	US26D
1	Perimeter Gasket	By Storefront Manuf.		
1*	Exterior Trim Plate	990NL	Von Duprin	US26D

*** ONLY AT DOOR B123B**

Door Hardware Set No. 11 – 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**	Exterior Trim Plate	990EO	Von Duprin	US26D

*** ONLY AT DOORS A118B, A118C, B104A, B104B, B104C, B104D, B123A, B126C, B126D.**
**** ONLY AT DOORS A101D, A101E, B121A, B121B, C147A, C147B, C149A, C149B**.

Door Hardware Set No. 11A – Exterior Exit HM without Access Control

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Exit Device	CD 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	Weatherstrip	316 APK.	Pemko	A
1	Kickdown Holder	FS452-4	Ives	US26D
1	Threshold	2748	Pemko	A
1*	Door Pull	990NL Trim Plate	Von Duprin	US26D

*** ONLY AT DOOR B105B.**

Door Hardware Set No. 11B – Interior Exit HM without Access Control (Electrical Rooms)

Qty.	Item	Description	Manufacturer	Finish
1	Cont. Hinge	112HD	Ives	US28
1	Exit Device	CD 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. 12 – Exterior 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	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	UD26D

*** ONLY AT DOORS A101F, A120A, B121C, C147C, C149C.**

Door Hardware Set No. 13 – 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.		
1*	Exterior Trim Plate	990NL	Von Duprin	UD26D

*** ONLY AT DOOR A101C**

Door Hardware Set No. 14 – Interior Exit without Access Control (latching – Main Entrance)

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	Perimeter Gasket	By Storefront Manuf.		
1*	Exterior Trim Plate	OEO	Von Duprin	US26D

*** ONLY AT DOORS A101A. A101B**

Door Hardware Set No. 15 – Exterior Storage Room (single door)

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	Latch Protector	NLP-106	Don-jo	630
1	Closer	4040XP-3077CNS	LCN	AL-689
1	Threshold	2748	Pemko	A
1	Weatherstrip	316 APK	Pemko	A
1	Door Shoe	2211PK	Pemko	A

Door Hardware Set No. 16 – Exterior Storage Room (double door)

Qty.	Item	Description	Manufacturer	Finish
2	Cont. Hinge	112HD	Ives	US28
1	Lockset	195F/G3	Marks	26D
1	Cylinder	20200V1(S) K 26 9C S	Medeco	US26D
1	Closer	4040XP-3077CNS	LCN	AL-689
2	Manual Flush Bolt	F358 (top and bottom)	Ives	US26D
2	Kickdown Holder	FS452-4	Ives	US26D
1	Threshold	2748	Pemko	A
2	Door Shoe	2211PK	Pemko	A
1	Weatherstrip	316 APK	Pemko	A
1	T Astragal	355CS	Pemko	C

Door Hardware Set No. 17 – Exterior Double Doors with / Access Control

Qty.	Item	Description	Manufacturer	Finish
2	Cont. Hinge	112HD	Ives	US28
1	Lockset	195F/G3	Marks	26D
1	Cylinder	20200V1(S) K 26 9C S	Medeco	US26D

1	Closer	4040XP-3077CNS	LCN	AL-689
2	Manual Flush Bolt	F358 (top and bottom)	Ives	US26D
1	Electronic Strike	6400	Von Duprin	US26D
1	Power Transfer	VDE EPT10	Von Duprin	SP28
2	Kickdown Holder	FS452-4	Ives	US26D
1	Threshold	2748	Pemko	A
2	Door Shoe	2211PK	Pemko	A
1	Weatherstrip	316 APK	Pemko	A
1	T Astragal	355CS	Pemko	C
2	Kick Plates	J101 30x34	Don-jo	626

Door Hardware Set No. 18 – Interior Double Doors (non-latching near Multipurpose)

Qty.	Item	Description	Manufacturer	Finish
2	Cont. Hinge	112HD	Ives	US28
1	Lockset	195DC/G3	Marks	26D
2	Cylinder	20200V0(S) K 26 9C S	Medeco	US26D
1	Closer	4040XP-3077CNS	LCN	AL-689
2	Manual Flush Bolt	F358 (top and bottom)	Ives	US26D
2	Kickdown Holder	FS452-4	Ives	US26D
1	T Astragal	355CS	Pemko	C
4	Kick Plates	J101 30x34	Don-jo	626
1	Perimeter Gasket	By Storefront Manuf.		

Door Hardware Set No. 19 – Miscellaneous Medeco Cores for Coiling Counter Doors, Sectional Door Locks, Sectional Door Control Units, and others 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 085113 "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.

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/SEI 7, based on heights above grade indicated on Drawings.

    a. Wind Design Data: As indicated on Drawings.
    b. Basic Wind Speed: 140 mph.
    c. Importance Factor: 1.0.
    d. Exposure Category: C.

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 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.

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. 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 Pariluse LLC; IE Blinds or comparable product by one of the following:

        1) ODL
        2) Thermat-Tru Corp.
        3) Unicel Architectural

2. Glazed integral blind units to be sealed at perimeter.
3. Integral blind units to be assembled and integrated with tempered and laminated glazing.
4. Controls: Single side direct drive.
5. 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.

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

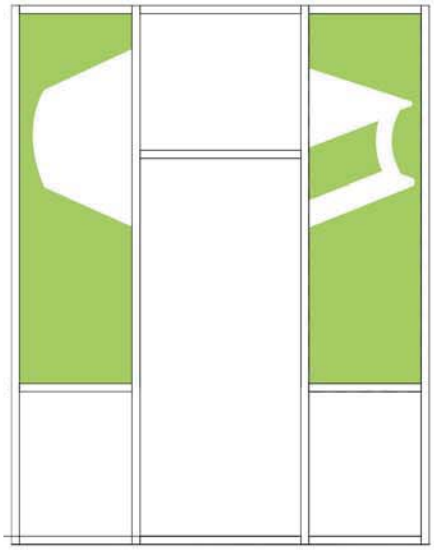
A. Panel Type - **G8**: Interior Insulating Opaque Composite Panel - Color 2

1. Minimum Thickness: 1 inch.

3.12 MANUAL INTEGRAL HORIZONTAL BLIND LITES AT DOORS – see Specification Sections 081113 Hollow Metal Doors and Frames, 081416 Flush Wood Doors, and 081743 Flush FRP Doors.

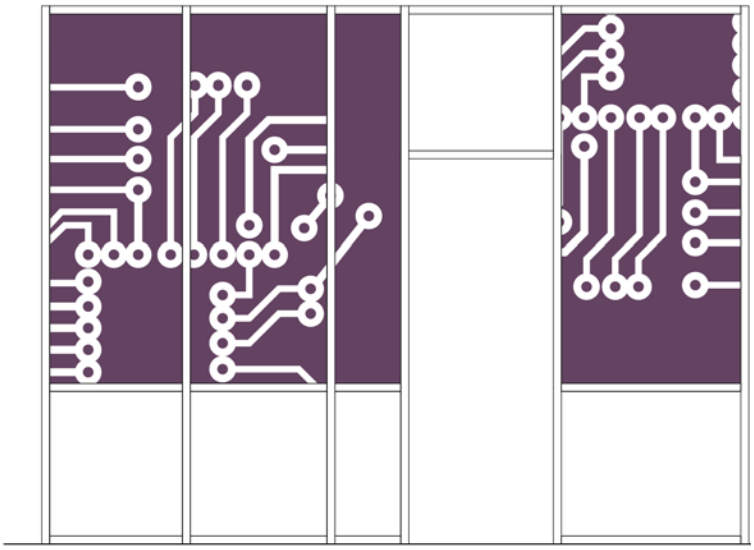
A. Panel Type - **G9**: Glazing with Integral Manual Blind

END OF SECTION 08 80 00



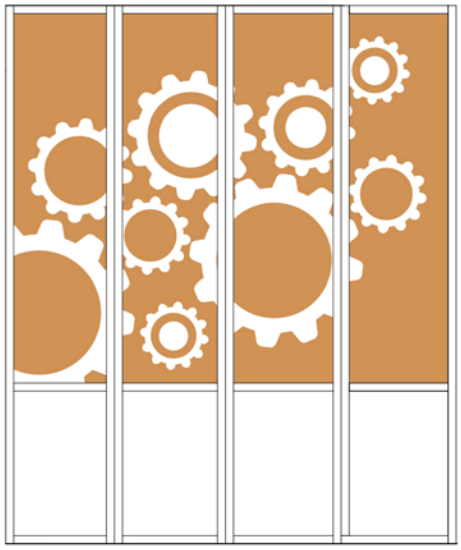
B21

Frame Type: AL
Frame Size: 0' - 6"



B22

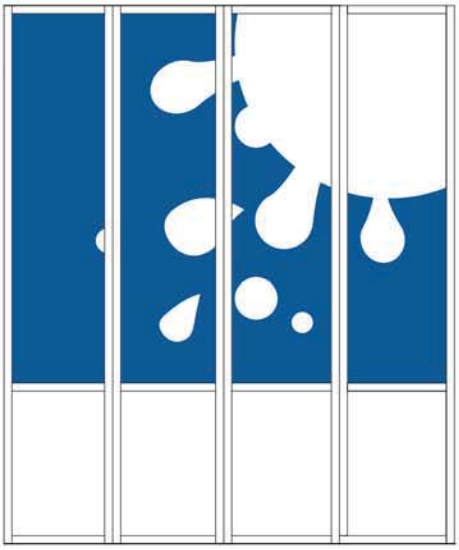
Frame Type: AL
Frame Size: 0' - 6"



B23

Frame Type: AL
Frame Size: 0' - 6"

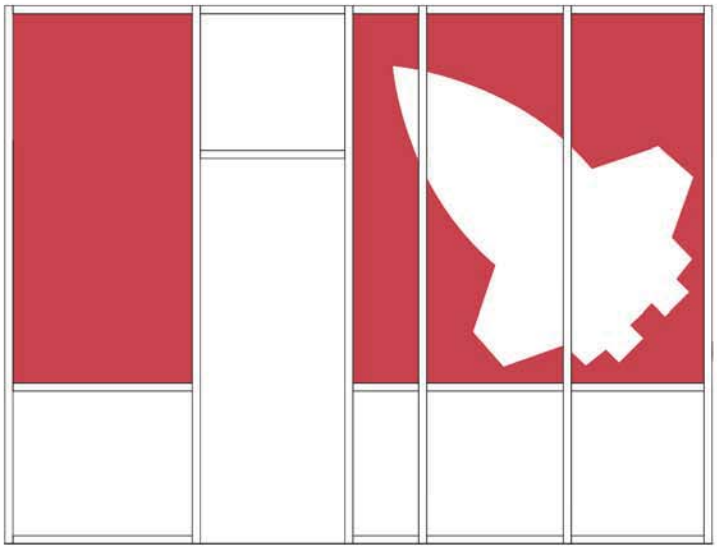
Unit B23a - Left of Overhead Door



B23

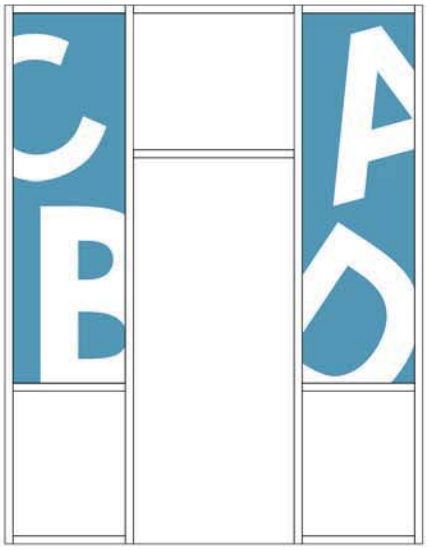
Frame Type: AL
Frame Size: 0' - 6"

Unit B23b - Right of Overhead Door



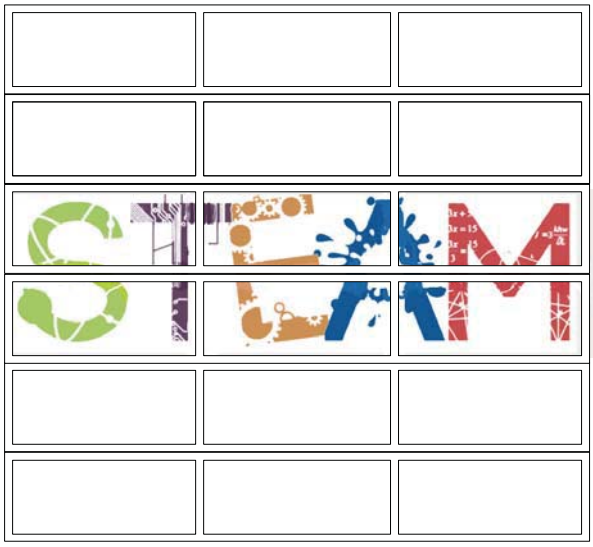
B24

Frame Type: AL
Frame Size: 0' - 4 1/2"



B25

Frame Type: AL
Frame Size: 0' - 6"



B26

Frame Type: AL
Frame Size: 0' - 6"

Typical two locations.

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 01 43 39 – “Classroom Mockup”.
2. Section 08 17 43 - "Flush FRP Doors” for security glazing within FRP Doors.
3. Section 08 41 13 - "Aluminum-Framed Entrances and Storefronts” for security glazing within storefronts.
4. Section 08 51 13 - "Aluminum Windows” for factory installed security glazing within window units.
5. Section 08 56 53 - “Transaction Security Windows” for transaction window & components at main entrance.

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.

B. Security Glazing **G5**: 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 " LP Laminated TSS002 L/S or equal.

2. Ballistic Resistance: Level 2 according to UL 752.
3. Forced Entry Rating: H.P. White TP-0500.01 Level I
4. Maximum Overall Unit Thickness: 1 inch.
5. Makeup:

THREAT SIDE
a. Layer 1: 1/4-inch Glass
b. Layer 2 .025-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.

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 08 91 19 - FIXED LOUVERS

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. Fixed, exterior extruded-aluminum louvers in CMU walls.

B. Related Requirements:

1. Section 08 41 13 - "Aluminum-Framed Entrances and Storefronts" for louvers in aluminum frames.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Continuous-Line, Drainable-Blade Louver L1: Drainable-blade louver with blade gutters (drains) in rear two-thirds of blades only and with semi recessed mullions capable of collecting and draining water from blades.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties: A4097 or comparable product by one of the following:

a. Architectural Louvers; Harray LLC.
b. Ruskin Company

2. Louver Depth: 4 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
4. Louver Performance Ratings:

a. Free Area: Not less than 50% for 48-inch-wide by 48-inch-high louver.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.5 BLANK-OFF PANELS

A. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: 2 inches.
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
3. Insulating Core: Rigid polyisocyanurate board insulation.
4. 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.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same type of finish applied to louvers, but black color.
7. Attach blank-off panels with sheet metal screws.

2.6 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.7 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

2. Coordinate frame sizes with masonry openings.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
2. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

G. Provide subsills made of same material as louvers for recessed louvers not in aluminum-framed storefronts.

H. Provide perimeter flanges of same material as louvers for recessed louvers not in aluminum-framed storefronts.

I. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

J. Provide caulking at edge of perimeter flanges.

2.8 ALUMINUM FINISHES

A. Finish louvers after assembly.

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 substrates and openings, 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. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

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, from ICC-ES.

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.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.

2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C645. Use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners:

   a. Minimum Base-Metal Thickness: As indicated on Drawings.
   b. Depth: As indicated on Drawings.

2. Dimpled Steel Studs and Runners:

   a. Minimum Base-Metal 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 Runner System: ASTM C645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner 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 runner 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. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: As indicated on Drawings.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal 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.

G. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Minimum Base-Metal Thickness: As indicated on Drawings.
2. Depth: As indicated on Drawings.

H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 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-metal 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 uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C645.

a. Minimum Base-Metal Thickness: As indicated on Drawings.
b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.

a. Minimum Base-Metal 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 runner 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.

B. Related Requirements:

1. Section 01 43 39 – “Classroom Mockup”
2. Section 06 16 00 - "Sheathing" for gypsum sheathing for exterior walls.
3. Section 07 92 00 - “Joint Sealants”.
4. Section 09 22 16 - "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
5. 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 MOCKUPS

A. See Section 01 43 39 – “Classroom Mockup”
1. Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 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.

1.7 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.

D. Abuse-Resistant Gypsum Board:

1. Basis of Design: Subject to compliance with project requirements, the design is based on the following: “USG Corporation, Sheetrock® Brand MoldTough® Abuse Resistant VHI Firecode® X”.
   a. Abrasion Resistance; Level 3
   b. Indentation Resistance; Level 1
   c. Soft Body Impact Resistance; Level 3
   d. Hard Body Impact Resistance; Level 2
2. UL Type Designation “AR”.
3. ASTM C1658/1658M Standard Specification for Glass Mat Gypsum Panels: 5/8 in. Type AR, with mold-and moisture-resistant core and surface paper.
4. ASTM E136 Noncombustibility: Meets or exceeds criteria.
5. ASTM E84 Surface-Burning Characteristics:
   a. Flame Spread: 15
   b. Smoke Developed: 0
   c. Classification: Class A
6. 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
7. Thickness: 5/8 inch (12.7 mm)
8. Length: [8′-0″ (2440 mm)], [10′-0″ (3050 mm)], [12′-0″ (3660 mm)]
9. Width: 4′-0″ (1220 mm)
10. Weight: 2.8 lbs./ft^2 (13.6 mm)
11. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet 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.

2.5 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.

2.6 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

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. Mock up 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.

B. 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.

3. 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:

   2. 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.

3. 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

1 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 21 13 00 - “Fire Suppression Sprinkler Systems” for penetrations in acoustical panel ceilings.
   2. Section 23 37 00 - “Air Outlets and Inlets” for HVAC registers in acoustical panel ceilings.
   3. 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.

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 ACOUSTICAL PANELS TYPE 2 @ PTA KITCHEN B109 & KITCHEN B116

A. Available Manufacturers: Subject to compliance with requirements, available manufacturers include, but are not limited to, the following:
   1. Armstrong World Industries, Inc. – Kitchen Zone 673
   2. Or equal.

B. Classification: Provide panels complying that meet USDA/FSIS guidelines
   1. Smooth Surface, durable, Water-repellent, washable, scratch resistant, soil resistant.
   2. Color: White.
   3. Edge/Joint Detail: Square
   4. Thickness: 3/4 inch.
   5. Size: 24 inches by 24 inches.
   6. NRC: N/A
   7. CAC: 33
   8. Class A
   9. Light Reflectance: 0.89

2.5 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 for 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.

2.6 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”

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.

2.7 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.

2.8 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 stair accessories.
3. Rubber molding accessories.

B. Related Requirements:

1. Section 01 43 39 - “Classroom Mockup” for installation of rubber base in the Classroom Mockup.

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.

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.

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

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. Section 09 65 13 - “Resilient Base and Accessories” for transition strips between resinous flooring and resilient flooring – if required.
2. Section 01 43 39 - “Classroom Mockup” for installation of MMA flooring in the Classroom Mockup.

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

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 Strength300-400+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 3.04.01.

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 3.04.01.

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. Testing: Verification elevator cab flooring meets ASTM E648-08 - Standard Test Method for Critical Radiant Flux Floor Covering Systems.

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. Tandus | Centiva 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. Style: 11644 Color Spectrum II
b. Color: To be Selected by Architect from full range.

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 Tandus | Centivs Flooringis installed, specifically peel-and-stick 6' wide rolls of Color Spectrum carpet, the contractor shall be responsible for contacting:

Tandus 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.
   3. Section 01 43 39 - “Classroom Mockup” for installation of rubber base in the Classroom Mockup.

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 B119:
   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 B119:

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 78 13 – METAL INTERIOR WALL PANELING

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 Wall panels for wall protection at Kitchen B116 and Drinking Fountain in Multi-Purpose Room.

1.3 SUBMITTALS

A. Product Data: Manufacturer's printed product data for each type of stainless-steel wall panel systems specified.

B. Manufacturer's Installation Instruction: Printed installation instructions for stainless steel wall panels.

C. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.

D. Samples for Initial Selection: For each type of wall covering and trim indicated.

E. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

F. Qualification Data: For qualified testing agency.

G. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate layout and installation of metal interior wall paneling with adjacent construction.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain metal interior wall paneling system components from a single source.

B. Deliver materials in original factory packaging, labeled with manufacturer, brand name, size, color, and lot number.

C. Store materials in original, undamaged packaging inside a well-ventilated area protected from weather, moisture, soiling, sunlight, and extreme temperatures. Maintain room temperature within the storage area at not less than 68° F (20° C) during the period materials are stored.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install metal interior wall paneling 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 metal interior wall paneling 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 metal interior wall paneling manufacturer for full drying or curing.

1.7 WARRANTY

A. Submit manufacturer's limited lifetime written warranty against material and manufacturing defects.

PART 2 - PRODUCTS

2.1 METAL INTERIOR WALL PANELING

A. General: Provide stainless steel wall panel systems that include panels, outside corners and inside corners. Panel system shall include stainless steel panels that have recessed overlap joints that maintain panel flatness and minimizes panel protrusion.

1. Panel Size: 4 feet x 10 feet maximum.
2. Panel Thickness: 18 gauge.
3. Panel Type: Stainless Steel - Type 430 or type 304 (type 304 conforms to NSF Standard 51)
4. Finish: No. 4 satin finish.

B. Products: Subject to compliance with requirements, provide one of the following:

1. InPro Corporation.
2. PolyVision.
3. Babcock-Davis.

C. Stainless Steel Inside Corners: 2" (50.8mm) x 2" (50.8mm) 16 gauge. Full Height (floor to ceiling), edges shall have an 11° taper.

1. Material: Stainless Steel - Type 430 or type 304 (type 304 conforms to NSF Standard 51)
2. Attachment: Adhesive mount or screw mount.
3. Finish: No. 4 satin finish.
4. Edges shall be finished with color-matched caulk.

D. Stainless Steel Outside Corners: 2" (50.8mm) x 2" (50.8mm), 16 gauge. Full Height (floor to ceiling), edges shall have an 11° taper.

1. Material: Stainless Steel - Type 430 or type 304 (type 304 conforms to NSF Standard 51)

2. Attachment: Adhesive mount.
3. Finish: No. 4 satin finish.
4. Edges shall be finished with color-matched caulk.

E. Adhesive: Heavy duty construction or rubber-based adhesive in accordance with manufacturer's written recommendations.

F. Foam Tape: Heavy duty adhesive foam tape in accordance with manufacturer's written recommendations.

G. Fasteners: Stainless steel Phillips head screws into counter sunk beveled mounting holes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which the wall panel systems will be installed.

B. Complete all finishing operations, including painting, before beginning installation of wall panel system materials.

C. Wall surface shall be dry and free from dirt, grease and loose paint.

D. 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. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

3.3 INSTALLATION

A. Comply with manufacturer's printed installation instructions.

B. Locate the wall panels as indicated on the approved detail drawing for the appropriate substrate and in compliance with the manufacturer's instructions. Install wall panels level and plumb at the height indicated on the drawings. Complete installation with inside and outside corners.

C. Install panels square and true.

3.4 CLEANING

A. Clean panels using cleaning methods recommended in writing by wall paneling manufacturer.

B. Replace panels that cannot be cleaned.

C. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 78 13

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 05 75 00 - “Decorative formed Metal” for the painting of metal components of exterior perforated metal screen panels at Stair 2, steel components of structural steel canopies. And steel gate louvered infill panels at Gas Enclosure, Transformer Enclosure, and Trash Compactor Enclosure
4. 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

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 51 13 - “Metal Pan Stairs” for the painting of steel components of metal pan stairs.
4. Section 05 20 00 - “Metal Joists” for surface preparation and the application of primer coats on exposed steel members.
5. Section 08 11 13 - “Hollow Metal Doors and Frames “for the painting of hollow metal doors and frames.
6. Section 09 91 13 - "Exterior Painting" for surface preparation and the application of paint finishes on exterior substrates.
7. Section 01 43 39 - “Classroom Mockup” for installation of rubber base in the Classroom Mockup.
8. Section 03 34 50 – “Concrete Finishes” for the painting of concrete floors designated to receive epoxy paint.
9. 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

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 09 93 00 - STAINING AND TRANSPARENT FINISHING

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 surface preparation and application of wood stains and transparent finishes on the following substrates:

1. Interior Substrates:

a. Dressed lumber (finish carpentry or woodwork).

B. Related Requirements:

1. Section 06 41 16 - “Plastic-Laminate-Faced Architectural Cabinets for transparent finishes on exposed wood.

2. Section 06 42 16 – “Flush Wood Paneling” for transparent finishes on MDF paneling.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of product.

C. Samples for Verification: For each type of finish system and in each color and gloss of finish required.

1. Submit Samples on representative samples of actual wood substrates, 8 inches long.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

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 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point, or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

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:

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include but are not limited to products listed in wood finish systems schedules for the product category indicated.

2.2 MATERIALS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior stains and finishes applied at project site, the following VOC limits, exclusive of colorants added to a tint base.

1. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.

D. 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.

2.3 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

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 the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish 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.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Interior Wood Substrates:

1. Scrape and clean knots and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
3. Sand surfaces exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

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 finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage 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 finished wood surfaces.

3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

A. Wood Substrates: Wood trim.

1. Moisture-Cured Clear Polyurethane over Stain System MPI INT 6.3Y:

a. First Intermediate Coat: Moisture-cured polyurethane matching topcoat.
b. Second Intermediate Coat: Moisture-cured polyurethane matching topcoat.
c. Topcoat: Varnish, polyurethane, moisture cured, gloss (MPI Gloss Level 6), MPI #31.

END OF SECTION 09 93 00

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.
2. Markerboards – door 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.

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.
2. Bestrite 202AH 4’ x 8’ Marker Board Porcelain Steel (608513) with map rail & dura-safe end caps packed & shipped in singles.
3. Bestrite 202AG 4’ x 6’ Marker Board Porcelain Steel (608513) with map rail & dura-safe end caps packed & shipped in singles.
4. Bestrite 202AD 4’ x 4’ Marker Board Porcelain Steel (608513) with map rail & dura-safe end caps packed & shipped in singles.

2.7 VISUAL DISPLAY SURFACES – DOOR MOUNTED – See Door Schedule on Drawings

A. Visual Display Board: Factory assembled.

1. Markerboard: Porcelain-enamel markerboard assembly.
   a. Color: White.
2. Corners: Square.
3. Width: 3’-0”.
4. Height: 6’-0”.
5. Mounting: Wall.
6. Mounting Height: As indicated on Drawings.
7. Factory-Applied Aluminum Trim all sides: Manufacturer's standard with clear anodic finish.

B. Visual Display Surface Schedule:

1. Bestrite Custom 3’ x 6’ Marker Board Porcelain Steel with trim 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 12 00 - DISPLAY CASES

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. Display cases.

B. Related Requirements:

1. Section 09 22 16 - “Non-Structural Metal Framing” for framing to support display cases.
2. Section 09 29 00 - “Gypsum Board” for finishing surfaces surrounding display cases.
3. Section 07 92 00 - “Joint Sealants”.

1.3 DEFINITIONS

A. Display Case: Glazed cabinet with tackboard panel, without shelves, typically of shallow depth for display of paper documents.

B. Tackboard Panel: A material for holding push-pins or tacks, typically consisting of a facing such as fabric, vinyl, or cork; adhered to a substrate such as fiberboard, hardboard, or particleboard.

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 display cases. Include furnished specialties and accessories.

B. Samples: For each exposed product and for each color and texture specified; not less than 8-1/2 by 11 inches for tackboard panels and 6 inches long for trim with factory finish.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For display cases to include in maintenance manuals.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install display cases for indoor installations 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain display cases from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. 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: 25 or less.
2. Smoke-Developed Index: 50 or less.

2.3 DISPLAY CASES

A. Basis-of-Design Product: Subject to compliance requirements, provide 96” x 48” x 8” deep (max) Harbor Recessed Wall Display Case, by Allen Display, or equal.

B. Recessed Display Case: Factory-fabricated display case; with finished interior, operable glazed doors at front, and trim on face to cover edge of recessed opening.

1. Display Case Cabinet: Extruded aluminum.
2. Face Frame: Aluminum.
3. Face Frame: with finish.
4. Aluminum Finish: Clear anodic.

C. Glazed Sliding Doors: Tempered glass; unframed; with extruded-aluminum top and bottom track; supported on nylon or ball-bearing rollers; with plastic top guide and rubber bumpers. Equip each door with ground finger pull and adjustable cylinder lock with two keys.

1. Thickness: Not less than 5 mm thick.
2. Number of Doors: Three.

D. Back Panel: Natural-Cork Tackboard: 1/4-inch thick, natural cork sheet factory laminated to ¼-inch-thick, hardboard backing.

2.4 MATERIALS

A. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish.

B. Hardboard: ANSI A135.4, tempered.

C. Extruded-Aluminum Bars and Shapes: ASTM B 221, Alloy 6063.

D. Aluminum Tubing: ASTM B 429/B 429M, Alloy 6063.

E. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

F. Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

2.5 FABRICATION

A. Fabricate display cases to requirements indicated for dimensions, design, and thickness and finish of materials.

B. Use metals and shapes of thickness and reinforcing required to produce flat surfaces, and to impart strength for size, design, and application indicated.

C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

D. Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 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 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.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, 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 backing for display cases.

C. Examine walls and partitions for suitable framing depth if recessed units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for display cases as required by type and size of unit.

3.3 INSTALLATION

A. General: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

1. Mounting Height: 72 inches above finished floor to top of cabinet.

B. Recessed Display Cases: Attach units to wall framing with fasteners at not more than 16 inches o.c. Attach aluminum trim over edges of recessed display cases and conceal grounds and clips. Attach trim with fasteners at not more than 24 inches o.c.

3.4 ADJUSTING AND CLEANING

A. Adjust doors to operate smoothly without warp or bind and so contact points meet accurately. Lubricate operating hardware as recommended in writing by manufacturer.

B. Touch up factory-applied finishes to restore damaged areas.

END OF SECTION 10 12 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. Emergency Response Room Identification: Fire Riser Room, FACP & Electrical Room

B. Related Requirements:

1. Section 14 21 00 - "Hydraulic Elevators" for code-required conveying equipment signage.
2. Section 22 05 53 - "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
3. Section 23 05 53 - "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
4. 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. 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. ACE Sign Systems, Inc.
2. APCO Graphics, Inc.
3. Diskey Architectural Signage Inc.

C. 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.
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".
2) Lettering for room ID signs shall be 3/4".
3) Symbol size shall be 4".
4) Standard Grade 2 braille shall be 1/2" 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 concealed 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 1" high.
2. Lettering for room usage identification shall be 5/8 inches high.
3. Lettering for rest room identification shall be 1 inch high.

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 fence fabric with steel hog rings.
      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:

C101	C201
C102	C202
C103	C203
C104	C204
C105	C205
C106	C206
C107	C207
C108	C208
C109	C209
C110	C210
C111	C211
C112	C212
C113	C213
C114	C214

2.8 EXIT MAP FRAMES.

1. Sixty-five (65) Owner-furnished, contractor installed exit map frames shall be attached to interior walls. Locations to be coordinated with the Owner’s personnel.

2.9 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.

2.10 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.

E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

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.

2. Character Material: Cast aluminum.
3. Character Height: 12 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 22 39 - FOLDING PANEL PARTITIONS

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. Manually operated, acoustical panel partitions.

B. Related Requirements:

1. Section 05 50 00 - "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
2. Section 08 70 00 - Door Hardware

1.3 DEFINITIONS

A. NIC: Noise Isolation Class.

B. NRC: Noise Reduction Coefficient.

C. STC: Sound Transmission Class.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For operable panel partitions.

1. Include plans, elevations, sections, details, numbered panel installation sequence, and attachments to other work.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:

1. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.
2. Hardware: One of each exposed door-operating device.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling 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. Partition track, track supports and bracing, switches, turning space, and storage layout.
2. Suspended ceiling components.
3. Structural members to which suspension systems will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling including the following:
6. Lighting fixtures.
7. HVAC ductwork, outlets, and inlets.
8. Speakers.
9. Sprinklers.
10. Smoke detectors.
11. Access panels.
12. <Insert item>.

B. Setting Drawings: For embedded items and cutouts, including support-beam, mounting-hole template.

C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
b. Seals, hardware, track, track switches, carriers, and other operating components.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 *Standard Practice for Architectural Application and Installation of Operable Partitions.*

D. The operable wall must be manufactured by a certified ISO-9001-2015 company or an equivalent quality control system.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of operable panel partitions.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

3. Suspension System Warranty: Five (5) years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the partition panels will remain in place without separation of any parts from the system when subjected to the seismic forces specified."

B. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.
2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C423, and rated for not less than the NRC indicated.
3. Noise-Isolation Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E336, determined by ASTM E413, and rated for 10 dB less than STC value indicated.

2.2 OPERABLE ACOUSTICAL PANELS

A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Manufacturers: Subject to compliance with requirements,
2. Basis-of-Design Product: Subject to compliance with requirements, provide PANELFOLD MODUFLEX SERIES 400 OPERABLE WALLS, Model OP-02: Acousti-Seal Premier - Single Panel Manually operated individual panel operable partition or comparable product by other manufacturers.

B. Panel Operation:
1. Manually operated, individual panels top supported with operable floor seals.
2. Final Closure: Horizontally expanding panel edge with removable crank

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: Standard widths.

E. STC: Not less than 50.

F. Panel Weight: 8 lb/sq. ft. maximum.

G. Panel Thickness: Not less than 3 inches.

H. Panel Closure: Manufacturer's standard unless otherwise indicated.

I. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

1. Hinges for Closure Panels, Pass Doors, and Pocket Doors shall be:
   a. Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

J. Single Pass Door: Where indicated shall be nominally 3'-0" (914) wide by 7'-0" (2134) high. Door shall be manufactured of the same materials and thickness as the panels and be equipped with butt-type hinges and positive latches with drop cup and ring pulls. Double doors have roller latches.
1. Provide the following:
   a. Self-illuminated exit signs.
   b. Hydraulic door closers.
   c. Panic hardware with lock. Lock shall accept cylinder cores as specified in Section 08 71 00 Door Hardware and allow for cylinder dogging.
   d. All hardware is to be installed by the panel manufacturer.

2.3 SEALS

A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:

1. Manufacturer's standard seals unless otherwise indicated.
2. Seals made from materials and in profiles that minimize sound leakage.
3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.

C. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.

D. Horizontal Bottom Seals: Manually activated seals providing nominal 2" (51mm) operating clearance with an operating range of + 0.50" (13mm) to -1.50" (38mm). Seal shall be operable from panel edge or face. Extended seal shall exert nominal 120 pounds (54 kg) downward force to the floor throughout operating range.

E. PANEL FINISH FACINGS

F. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
1. High-Pressure Decorative Laminate: NEMA LD 3, Horizontal grade.

2. Color/Pattern: As selected by Architect from manufacturer's full range.

G. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.4 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum mounted directly to overhead structural support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

1. Curve-and-Diverter Switches: Allow radius turns to divert panels to an auxiliary track.
2. L Intersections: Allow panels to change 90 degrees in direction of travel.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with ASTM E557 except as otherwise required by operable panel partition manufacturer's written installation instructions.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

F. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust pass doors to operate smoothly and easily, without binding or warping.

C. Verify that safety devices are properly functioning.

3.4 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service is to include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

END OF SECTION 10 22 39

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. Crash Rail at Kitchen B116.
   2. Wall bumper at Multi-Purpose B104
   3. 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. Crash Rail at Kitchen B116: Heavy-duty stainless-steel crash rails; designed to withstand impacts.

1. Manufacturers: Subject to compliance with requirements,
2. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties ECR-20S series; or similar product by one of the following:
   a. Babcock-Davis
   b. Construction Specialties, Inc.
   c. Inpro Corporation
3. Rail: 2” (50.8mm) high x ¼” (6.4mm) thick stainless steel, with continuous 2” radiused ends.
4. Provide stainless steel pipe mounting brackets.
5. Outside face of rail surface shall be no more than 3-1/4” from wall mounting surface.
6. Mounting: Coordinate location of mounting brackets with stainless steel wall panel seams.

B. Bumper Rail at Multi-Purpose Room B104: Assembly consisting of continuous snap-on plastic cover installed over concealed, continuous retainer; designed to withstand impacts.

1. Manufacturers: Subject to compliance with requirements,
2. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties SCR-48M series; w/ Acrovyn cover or comparable product by one of the following:
    a. Babcock-Davis
    b. Construction Specialties, Inc.
    c. Inpro Corporation

3. Cover: Injection molded plastic.
    a. Height: 6 inches
    b. Lengths: Standard solid 8-foot lengths.
    c. Finish Color: **Black.**

4. End Caps and Corners: Prefabricated, injection-molded plastic; matching color cover; field adjustable for close alignment with snap-on cover.
5. Accessories: Concealed splices and mounting hardware.
6. Mounting: Extended mounting on injection-molded plastic mounting brackets.

C. 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.

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.
5. Cane detection devices.

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 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. Grab Bar [O]:

1. Basis-of-Design Product: Bobrick; B-6861.99 Two-Wall Shower Stall Peened Grab Bar.
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: Two wall.

H. Folding Shower Seat [P]:

1. Basis-of-Design Product: Bobrick; B-5181 Reversible Folding Shower Seat.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel 16-gauge 1-1/4” square tubing and 18 gauge 1” diameter seamless tubing.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
    b. Seat: On-piece ½” thick, solid phenolic

I. Sanitary-Napkin Disposal Unit [L]:

1. Basis-of-Design Product: Bobrick; B-270.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover, and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

J. 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.

K. 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.

L. Electric Hand Dryer [Q]:

1. Basis-of-Design Product: Bobrick; B-7128, or Equal.
2. Mounting: Surface mounted.
3. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
4. Voltage required: 115V AC, 15 Amp, 1725 Watts, 50/60Hz, Single Phase, UL Listed.

2.3 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.

2.4 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 CANE DETECTION DEVICES

A. Cane Detection
1. Basis-of-Design Product: Haws Model SK6 cane detection device.
2. Description: Stainless-steel, floor-mounted, ADA-compliant, bracket installed directly under the high side of a high-low drinking fountain.
3. Measurements: 5-1/4” W x 15” L x 3-1/4” H.
4. Install per manufacturer’s recommendations.

2.7 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 42 00 – DEDICATION PLAQUE

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. Dedication Plaque.

B. Related Sections:

1. Masonry Work: Division 04
2. Section 09 22 16 - "Non-Structural Metal Framing" for blocking and strap required for mounting the dedication plaque.

1.3 DEFINITIONS

A. DEDICATION PLAQUE to be located within the building by Owner. Contractor to install.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, installation instructions, and general recommendations. Include data substantiating that products to be furnished comply with requirements of the contract documents.

B. Shop Drawings: Submit complete shop drawings for fabrication and erection, including plans, elevations, and large-scale details of typical sections and connections

1. Provide location and details of anchorage devices to be embedded in or fastened to other construction.
2. Include schedule and erection procedure for proper installation.

C. Verification Samples: To verify compliance with requirements of contract documents, submit complete sets of samples, illustrating full range of color and texture to be expected in the completed work. Provide samples of minimum size as follows:

1. Two 3 inch by 4 inch samples of texture and finish.

D. Submit a full-size rubbing of Dedication Plaque to architect for review and approval prior to fabrication but after obtaining initial approval of text, layout, design and finish.

1.5 QUAILTY 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.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Pack and otherwise protect each unit to avoid damage during shipping and handling.

B. Delivery and Storage: keep materials dry at all times. Protect against exposure to weather and against contact with damp or wet surfaces.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate work of this section with other trades so as not to create any delay in the progress of work.

1.8 WARRANTY

A. Special project Warranty: Submit a written warranty signed by the manufacturer, the contractor, and the installer, guaranteeing to correct failures in materials and workmanship which occur within the warranty period, including those attributable to abnormal aging, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents.

1. The warranty shall include responsibility for removing and replacing other work as necessary to accomplish repairs or replacement of materials covered by the warranty.
2. Warranty period: 1 year after substantial completion.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plaques to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 DEDICATION PLAQUE

A. This design is based on the following product: Matthews International Corporation, 1315 West Liberty Ave., Pittsburg, PA 15226, (800) 628-8439.

1. Plaque Material: Cast bronze.
2. Construction: Pebble background with integrally cast border.
3. Integrally Cast Border Style: Square single line, polished, ½" wide.
4. Plaque Thickness: 0.50 inch.
5. Text: Raised Helvetica
6. Colors: Satin Aluminum.
7. Size: Approximately 24 inches by 36 inches.
8. Location: Coordinate location with architect and owner.
9. Mounting: Concealed studs, on masonry wall.
10. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

B. Text and Graphics: Final text and graphics to be determined by Washoe County School District but, at a minimum, to include school logo (graphics), school moto, school name, school board president, school board members, date of dedication, name of architect, and name of contractor.

C. Materials
   a. Bronze Castings: ASTM B584, lead-free alloy recommended by manufacturer and finisher for finish indicated.

D. Fabrication

a. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

E. 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. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
   d. 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. 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 PREPARATION

A. Clean substrate, remove projections and substances detrimental to the work; comply with recommendations of manufacturer of products to be installed for preparation procedures.

3.3 INSTALLATION

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. 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 plaque. Remove loose debris from hole and substrate surface.
   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.

3.4 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques 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 plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

1. For cleaning, use only products and techniques acceptable to manufacturer of products being cleaned.

3.5 PROTECTION

A. General: Institute protective procedures and install protective materials as required to ensure that work of this section will be without damage or deterioration at substantial completion.

END OF SECTION 10 42 00

SECTION 10 44 13 - FIRE PROTECTION AND MEDICAL EQUIPMENT 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.
2. Automated external defibrillator cabinet for the following:
   a. Owner-furnished automated external defibrillator device.
3. Medical Evacuation Sled (Med Sled) cabinets for the following:
   a. Owner-furnished medical evacuation sleds (Med Sleds).
4. Combination AED & Bleeding Control Cabinet for the following:
   a. Owner-furnished AED & Bleed Control Kits.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Larsen's Manufacturing Company; AL2409-6R Semi-Recessed cabinet or comparable product.

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 AUTOMATED EXTERNAL DEFIBRILLATOR CABINET- mount in Admin Assistant A102.

A. Cabinet Type: Suitable for automated external defibrillator 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:
2. Basis-of-Design Product: Subject to compliance with requirements, JL Industries; AED Cabinet 1426.

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. 1-1/2” square trim.
2. Interior finish: White powder-coat.

E. Cabinet Trim Material: Clear anodized aluminum sheet.

F. Door
1. Material: Clear anodized aluminum sheet.
2. 1-3/4” trim in 5/8” stop.
3. Zinc plated handle
4. Roller catch

5. Continuous hinge.
6. Acrylic window with standard AED graphic.

2.5 MEDICAL EVACUATION SLED (MED SLED) CABINETS

A. Cabinet Type: Suitable for two medical evacuation sled devices.

1. Products: Subject to compliance with requirements, available 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, Double Steel Case Storage Device #MSSDSC2 by Ethos Evacuation Strategies, 2285 Grissom Dr., St. Louis, MO 63146 www.ethospreparedness.com 1-866-207-5993 www.medsled.com

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Steel sheet.

D. Surface-mounted Cabinet:
1. Interior finish: White powder-coat.

E. Door
1. Material: Clear anodized aluminum sheet.
2. 1-3/4” trim in 5/8” stop.
3. Zinc plated handle
4. Roller catch

2.6 COMBINATION AED & BLEEDING CONTROL CABINET

A. Cabinet Type: Suitable to hold an automated external defibrillator device and a bleeding control kit.
1. Products: Subject to compliance with requirements, available 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, #184-series cabinet with audio alarm by Modern Metal Products, 1200 12th Avenue NW, Owatonna, MN 55060, 800.435.5544 www.modern-metal.com

B. Cabinet Construction: Nonrated.

C. Cabinet Material: 20-gauge galvanized steel sheet.

D. Surface-mounted Cabinet:

E. Interior/exterior finish: White powder-coat.

F. Provide one internal shelf at mid-height in cabinet.

G. Provide audible alarm.

H. Door:

1. Material: Clear anodized aluminum sheet.
2. 1-3/4” trim in 5/8” stop.
3. Continuous hinge.
4. Roller catch
5. ADA-compliant chrome plated handle

2.7 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.
   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 10 75 00 - FLAGPOLES

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 flagpoles.

B. Related Sections:

1. Section 03 20 00 - “Concrete Reinforcement” for flagpole base reinforcing.
2. Section 03 30 00 - “Cast-In-Place Concrete” for concrete flagpole base.
3. Section 26 56 00 - "Exterior Lighting" for site lighting fixtures.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:

1. Seismic Loads: Category D according to SEI/ASCE 7.
2. Wind Loads: Determine according to NAAMM FP 1001. Basic Wind Speed = 140 mph.
3. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

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. Eder Flag Manufacturing Company
2. American Flagpole.
3. Morgan-Francis Flagpoles and Accessories.
4. U.S. Flag & Flagpole Supply, LP.

2.2 FLAGPOLES

A. Hinged Counterbalanced Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

B. Aluminum Flagpoles: Provide entasis-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

1. Length: 30 feet above ground.
2. Diameter: Entasis-tapered 6 inches at base.
3. Hinged 5’-9” above base with steel counterweight inside shaft.

2.3 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, 8” diameter, 14 gauge spun aluminum ball.

1. 0.063-inch spun aluminum, finished to match flagpole.

B. External Halyard, Winch System: Manually operated winch with control stop device and cast aluminum cleat, #10 Poly halyard, and cast aluminum no-fouling revolving truck assembly. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard.

a. Provide with neoprene or vinyl covers.

2. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Provide two flag clips per halyard.

a. Product: Subject to compliance with requirements, provide "Quiet Halyard" flag clasp by Lingo.

C. Stub Column:

1. Stub column & base plate shall be powder coated with a uniform finish.

2. Provide double nut steel bolts at base plate.

3. Bolts & nuts shall be painted to match base plate.

4. Provide ½" x 10'-0" copper clad grounding rod

2.4 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

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.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 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, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

B. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

C. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.

D. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION 10 75 00

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 # GIE18ETHWW 18.2 cu. ft. Top Freezer Refrigerator.
2. Type: Freestanding.
3. Dimensions:

    a. Width: 29.5 inches.
    b. Depth: 34.25 inches.
    c. Height: 66.6 inches.

4. Storage Capacity:

    a. Refrigeration Compartment Volume: 13.10 cu. ft.
    b. Freezer Volume: 5.10 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 WASHERS AND DRYERS

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).
2. Sears Brands LLC (Kenmore).
3. Whirlpool Corporation.

C. Clothes Washer: Complying with ASSE 1007.

1. Basis-of-Design Product: GE Model # GFW430SSMWW 4.5 cu. ft. Front-Load Washer.
2. Type: Freestanding, front-loading unit.
3. Dimensions:

a. Width: 27 inches.
b. Depth: 33.5 inches.
c. Height: 39.75.

4. Drum: Perforated stainless steel - tilted.

a. Capacity: 4.5 cu. ft.

5. Controls: Rotary-dial controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.

a. Wash Cycles: Ten wash cycles including regular, delicate, and permanent press.
b. Wash Temperatures: Five settings.

6. Electrical Power: As indicated on Drawings.
7. Motor: Manufacturer's standard with built-in overload protector.

D. Clothes Dryer: Complying with AHAM HLD-1.

1. Basis-of-Design Product: GE Model # GFD43ESSMWW, 7.5 cu. ft. Electric Dryer w/ Wrinkle Guard.
2. Type: Freestanding, frontloading, electric unit.
3. Dimensions:

a. Width: 27 inches.
b. Depth: 33 inches.

c. Height: 39.3 inches.

4. Drum: Dura Drum.

a. Capacity: 7.5 cu. ft.

5. Controls: Rotary-dial controls for drying cycle, temperatures, and fabric selectors.
6. Electric-Dryer Power: As indicated on Drawings.
7. Features:

a. Removable lint filter.
b. Electronic temperature and moisture level sensor control.
c. End-of-cycle signal.
d. Interior drum light.
e. Self-leveling legs.
f. Antibacterial cycle.

8. Appliance Finish: Porcelain enamel on top and lid; baked enamel on front and sides.

a. Color: White.

2.7 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.

2.8 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.

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 11 40 00 - FOODSERVICE EQUIPMENT

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 equipment.
2. Walk-in refrigeration equipment.
3. Serving equipment.

B. Related Requirements:

1. Section 23 34 00 - "Kitchen Hoods" for ventilation hoods.
2. Section 26 05 03 -” Equipment Wiring Connections” for connecting power to kitchen hoods and walk-in cooler & freezer condensers.

1.3 COORDINATION

A. Coordinate foodservice equipment layout and installation with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate locations and requirements of utility service connections.

C. Coordinate sizes, locations, and requirements of the following:

1. Overhead equipment supports.
2. Equipment bases.
3. Floor depressions.
4. Insulated floors.
5. Floor areas with positive slopes to drains.
6. Floor sinks and drains serving foodservice equipment.
7. Roof curbs, equipment supports, and penetrations.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include the following:

1. Manufacturer's model number.
2. Accessories and components that will be included for Project.
3. Clearance requirements for access and maintenance.
4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For foodservice equipment to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. Product Schedule: For each foodservice equipment item, include the following:

1) Designation indicated on Drawings.
2) Manufacturer's name and model number.
3) List of factory-authorized service agencies including addresses and telephone numbers.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.

1.8 WARRANTY

A. Refrigeration Compressor Warranty: Manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.

1. Failure includes, but is not limited to, inability to maintain set temperature.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.

B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

C. Regulatory Requirements: Install equipment to comply with the following:

1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
2. NFPA 70, "National Electrical Code."
3. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."

D. Seismic Restraints: Comply with SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines," Appendix A, "Seismic Restraint Details," unless otherwise indicated.

2.2 COOKING EQUIPMENT

A. Ovens:

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 Blodgett; Convection Oven, Electric Model ZEPH-200-E DBL or comparable product by one of the following:

   a. Vulcan; Division of ITW Food Equipment Group LLC.
   b. Imperial Commercial Cooking Equipment

3. Description: Electric convection.

   a. Accessories:

      1) Oven Rack(s): Five per oven chamber.
      2) Stainless-steel drip pan.
      3) Down-draft flue diverter.
      4) 6" Casters.
      5) 72” flexible electrical whip
      6) 208 VAC 60 HC. 3 Phase 11KW 31/29/29 Amperes

   b. Electrical Service: Equip unit for connection to service indicated on Drawings.

B. Insulated Hot Cabinet:

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 Cres Cor; Model H-138-1834D or comparable product by one of the following:

   a. Vulcan; Division of ITW Food Equipment Group LLC.
   b. Lockwood USA.

3. Description: Electric – 120 Volt Service

   a. Accessories:
      1) Floor lock.
      2) Casters.
      3) Magnetic door latch.
      4) Perimeter bumpers.

   b. Electrical Service: Equip unit for connection to service indicated on Drawings.

2.3 WALK-IN REFRIGERATION EQUIPMENT

A. Walk-in Refrigeration Units:

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 Nor-Lake, Inc.; Fineline Walk-ins, or comparable product by one of the following:

   a. Barr Refrigeration.
   b. Bush Refrigeration.
   c. U.S. Cooler.

3. Description: Two-compartment unit, with cooler and freezer compartments.

   a. Wall and Ceiling Panels: Interlocking insulating panels.
   b. Floors: Manufacturer's insulated floor panels on concrete slab with concrete slab above as finish floor.
   c. Access Doors:

      1) Width: 36 inches.
      2) Hinges: Self-closing and spring loaded; three per door.
      3) Latch: Edge-mounted, positive-type latch with cylinder lock.
      4) Include safety-release handle that opens door from inside when door is locked.
      5) Threshold: Provide flat 20 gauge stainless steel threshold, with 1/8" max. height.

   d. Glass Sliding Service Doors:

      1) Size: 48 inches by 54 inches, with locking device.

   e. Four-Post Shelf System.

      1) Storage: Full length, each side of each Unit.
      2) Service: Full width of Sliding Service Door.

   f. Vaporproof Lighting Fixtures:

      1) Control: Neon pilot light and toggle switch located on exterior of door panel.
      2) Quantity: One per compartment, located on door panel.
      3) Provide bypass for lights on timer.

   g. Refrigeration System: Remote system with preassembled condensing unit and evaporator assemblies.

      1) Exterior Condensing Units: Include winter control, crankcase heater, and enclosed weatherproof housing.

      2) No R-12 refrigerant shall be used.

h. Temperature Monitoring System: Electronic monitoring and remote audible alarm system that warns when temperatures register 10 deg F above or below set temperature.
i. Closure Panels and Trim: Include closure panels and trim.
j. Electrical Service: Equip unit for connection to service indicated on Drawings.

4. Finishes:

a. Exposed Exterior Finish: White-painted aluminum.
b. Interior Finish: White-painted aluminum.
c. Closure Panels and Trim: Matched to exposed exterior finish of panels.

2.4 SERVING EQUIPMENT

A. Insulated Hot Server Cabinet:

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 Volrath Company; Signature Server Hot Food Base Item NO. 36150-5 well 30” high, or comparable product by one of the following:

a. Vulcan; Division of ITW Food Equipment Group LLC.
b. Lockwood USA.

3. Description: Electric.

4. Size: 27 inches wide by 74 inches long by 30” high.

5. Wells: Five Standard Hot
6. Accessories:
a. Base Color: Stainless Steel
b. Controls: Touch Temp (Standard)
c. Countertop Material: 18 Ga. Stainless Steel
d. Breath Guard Style: Classic Economy Buffet - NSF
e. Lighting: Heat Strips w/ Lights
f. Tray Slide, V-rib (18 Ga. Stainless Steel) on both Customer and Operator Sides
g. End Shelf (installed on opposite end as controls)
h. Base Unit Voltage: 120/208
i. NEMA Plug 14-50P.
7. Electrical Service: Equip unit for connection to service indicated on Drawings.

B. Insulated Cold Server Cabinet:

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 Volrath Company; Signature Server Refrigerated Cold Food Base Item No. 36176-5 well/30” high, or comparable product by one of the following:

a. Vulcan; Division of ITW Food Equipment Group LLC.
b. Lockwood USA.

3. Description: Electric.

4. Size: 27 inches wide by 74 inches long by 30” high.

5. Refrigerated.

6. Wells: Five Standard Cold.
7. Accessories:
   a. Base Color: Stainless Steel
   b. Controls: Touch Temp (Standard)
   c. Countertop Material: 18 Ga. Stainless Steel
   d. Breath Guard Style: Classic Economy Buffet - NSF
   e. Lighting: Flourescent
   f. Tray Slide, V-rib (18 Ga. Stainless Steel) on both Customer and Operator Sides
   g. End Shelf (installed on opposite end as controls)
   h. Base Unit Voltage: 120/208
   i. NEMA Plug 5-15P.
8. Electrical Service: Equip unit for connection to service indicated on Drawings.

2.5 MISCELLANEOUS MATERIALS

A. Installation Accessories, General: NSF certified for end-use application indicated.

B. Elastomeric Joint Sealant: ASTM C 920; silicone. Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.

1. Public Health and Safety Requirements:

   a. Sealant is certified for compliance with NSF standards for end-use application indicated.
   b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.

2. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

2.6 FINISHES

A. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: 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.

B. Powder-Coat Finishes: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install foodservice equipment level and plumb, according to manufacturer's written instructions.

1. Connect equipment to utilities.
2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

B. Complete equipment assembly where field assembly is required.

1. Provide closed butt and contact joints that do not require a filler.
2. Grind field welds on stainless-steel equipment until smooth and polish to match adjacent finish.

C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.

D. Install cabinets and similar equipment on bases in a bed of sealant.

E. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

F. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

END OF SECTION 11 40 00

SECTION 11 42 00 – CERAMIC KILN

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. 208V, 3-ph Cone 10 electric kiln.
2. Coordination with installation of electrical and mechanical system to ensure complete and functional equipment.
3. Accessory components including, but not limited to electrical connections, kiln master controller, furniture kit, and environment.

B. Related Sections:

1. Division 23 Section “HVAC Power Ventilators” and “Metal Ducts” for ventilation system.
2. Division 26 for power supply.

1.3 SUBMITTALS

A. Product Data: Submit detailed product data, including installation instructions with listing of all available accessories and materials provided by others.

B. Shop Drawings: Submit complete shop drawings and installation instructions including diagrams for connection to 208V 3-ph power as well as unit size and any required clearances.

C. Certificates: Submit manufacturer’s certification that products comply with requirements of the contract documents.

D. Maintenance Data: Submit manufacturer’s instructions for proper start-up and maintenance procedures.

1.4 QUAILTY ASSURANCE

A. Manufacturer’s Qualifications: Obtain required products from a single manufacturer.

1. Accessories: provide accessory items only as produced or recommended by manufacturer of primary products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and against contact with damp or wet surfaces.

B. Do not deliver kilns until building is completely enclosed and secure.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate work of this section with gypsum board, mechanical, and electrical assemblies to ensure preparation of rough framing and electrical supply to support kiln operation.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For ceramic kiln to include in operation and maintenance manuals.

1.8 WARRANTY

A. Submit a written warranty signed by the supplier that guarantees to correct failures in materials and workmanship which occur within the warranty period, including those attributable to abnormal aging, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents. The warranty shall include responsibility for removing and replacing other work as necessary to accomplish repairs or replacement of materials covered by the warranty. Warranty period is 2 years after date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Product: Subject to compliance with requirements, provide Model KM-1227PK-3ph, 208V, 46.7 Amp electric kiln as manufactured by Skutt Ceramic Products, Inc., 2618 S.E. Steele Street, Portland OR 97202, (503) 231-7726, or approved equal.

2.2 DESCRIPTION

A. Standard Features: Type K thermocouple, Solid State relays, Industrial gauge wiring, Compression connectors on feeder wires, Swing away, air cooled switch box, multi-side design, Stainless steel jacket, Sectionalized construction, 2 lift handles on each section, Sealed, dust-free lid with full-floating hinge, Three types of exposed, pinned elements for optimum balance, and Reversible top and bottom slabs.

B. Delay Firing Start: Up to 99 hours and 99 minutes.

C. Cone Fire Mode: Entry by cone number, 3 firing speeds, Cone 022 to cone 10.

D. Ramp/Hold Mode: Entry by temperature, create programs from 1 to 8 segments. Each segment can specify a rate of heating or cooling to a specified temperature with an optional hold, to maximum temperature of 2,350 degrees F.

E. Memory: Minimum of 6 firing programs.

F. Safety Features: Power failure detection, thermocouple failure detection, microprocessor fault detection.

G. Electronic Cone Table: Converts cone numbers to temperature.

H. Digital Readout: Fahrenheit or Centigrade.

I. Program Review: review program and current segment during firing.

J. Temperature Alarm: Adjustable to desired temperature.

K. Control Panel: Sealed touch pad.

L. Thermocouple: Encapsulated type K.

M. Ventilation: EnviroVent downdraft vent system.

a. Provide EnviroLink automatic fan controller.

N. Accessories: Furniture Kit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect and test power supply and exhaust as fully operational prior to installation.

3.2 INSTALLATION

A. Comply with architectural drawings for location and with manufacturer's instructions for assembly, installation and erection.

B. Electrical Wiring:
a. Electrical power wiring shall be configured such that the kiln may be accessed from both sides of the unit.
b. The excess cord for the exhaust fan shall be bundled, tied and secured in a neat & tidy manner.

C. Test electrically operated components to verify that all functions are operational.

3.3 PROTECTING AND CLEANING

A. After installation, protect kilns from damage during remainder of construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION 11 42 00

SECTION 11 52 13 - PROJECTION SCREENS

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. Electrically operated, front-projection screens and controls.

B. Related Requirements:

1. Section 05 50 00 - "Metal Fabrications" for metal support framing for front-projection screens.
2. Section 26 05 03 - “Equipment Wiring Connections” for connecting power to projection screens.

1.3 DEFINITIONS

A. Gain: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:

1. Drop lengths.
2. Details of juncture of exposed surfaces with adjacent finishes.
3. Location of wiring connections for electrically operated units.
4. Wiring diagrams for electrically operated units.
5. Accessories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For front-projection screens to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install front-projection screens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC

system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of front-projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Projection Screens: Obtain front-projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

2.2 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

A. General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Controls: Remote, key-operated, three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.

    a. Provide power supply for low-voltage systems if required.
    b. Provide key-operated, power-supply switch.
    c. Provide video interface control for connecting to projector. Projector provides signal to raise or lower screen.

3. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
4. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch-diameter metal rod with ends of rod protected by plastic caps.

    a. Roller for motor in roller is supported by vibration- and noise-absorbing supports.

5. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on each side of screen that is connected to edge of screen by tabs to pull screen flat horizontally. In lieu of tab tensioning, screens may be constructed from vinyl-coated screen cloth that contains horizontal stiffening monofilaments to resist edge curling.

B. Ceiling-Recessed, Metal-Encased, Electrically Operated Screens with Tab Tensioning: Motor-in-roller units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than 0.027 inch thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide with matching end caps and concealed mounting. Supply housing with non-motorized door.

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. Da-Lite Screen Company; Tensioned Large Advantage Deluxe Electrol. (Basis of Design)
b. Draper Inc; Premier.
c. Stewart Filmscreen Corporation; Luxus Model A ElectriScreen.

2.3 FRONT-PROJECTION SCREEN MATERIAL

A. Matte-White Viewing Surface: Peak gain of not less than 1.1.

B. Material: Draper; HD Progressive 1.1 or equal.

C. Mildew-Resistance Rating: Zero or 1 when tested according to ASTM G 21.

D. Flame Resistance: Passes NFPA 701.

E. Flame-Spread Index: Not greater than 75 when tested according to ASTM E 84.

F. Seamless Construction: Provide screens, in sizes indicated, without seams.

G. Edge Treatment: Black masking borders.

H. Size of Viewing Surface: 120 inches by 192 inches.

I. Screen Diagonal Image Size: 226”

J. Motor Voltage: 120V

K. Key Operated Wall Switch: Yes

L. Screen Aspect Ratio: 16:10 Wide Format

M. Screen Tensioned: Yes.

N. Provide extra drop length of dimensions and at locations indicated.

1. Color: Black.
2. Screen Black Drop (runout) at top of Screen: 12”

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.

a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.

END OF SECTION 11 52 13

SECTION 11 66 23 - GYMNASIUM EQUIPMENT

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. Basketball equipment.

B. Related Requirements:

1. Section 04 22 00 - “Concrete Unit Masonry” for coordinating attaching to backboards to CMU wall.
2. Section 06 42 16 - “Flush Wood Paneling” for coordinating attaching backboard supports in MDF panel soffits.

1.3 DEFINITIONS

A. FIBA: Federation Internationale de Basketball Amateur (The International Basketball Federation).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.

B. Shop Drawings: For gymnasium equipment.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, attachments to other work, and operational clearances.
3. Include transport and storage accessories for removable equipment.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Court layout plans, drawn to scale, and coordinated with floor inserts, game lines, and markers applied to finished flooring.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, 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.

B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.8 COORDINATION

A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Basketball backboard failures including glass breakage.
b. Faulty operation of basketball backstops.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain gymnasium equipment from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Basketball backstops and anchors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.3 BASKETBALL EQUIPMENT

A. Basis-of-Design Product: Subject to compliance with requirements, provide ADP Lemco Inc.; Model 800 wall mounted goal or comparable product by one of the following:

1. AALCO Manufacturing.

2. Draper Inc.
3. Spalding Equipment.

B. General: Provide equipment complying with requirements in FIBA's "Basketball Rule Book."

C. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

D. Provide manufacturer's recommended connections complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.

E. Wall-Mounted Backstops: Complete assembly extending from wall, including support framing to building structure, bracing, cables, support chains, pulleys, fittings, hardware, pipe anchors, equipment pads, and fasteners.

1. Stationary Type: Provide manufacturer's standard assembly for stationary backstop.
2. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.

    a. Finish: Manufacturer's standard primer for field finishing.

F. Basketball Backboards:

1. Basis-of-Design Product: Subject to compliance with requirements, provide ADP Lemco Inc.; Model 64 Glass Backboard or comparable product by one of the following:
    a. AALCO Manufacturing.
    b. Draper Inc.
    c. Spalding Equipment.
2. Shape and Size:
    a. Rectangular, 72” width by 42” height.
3. Backboard Material: Tempered Glass: Not less than 1/2-inch-thick, tempered glass which is set into 1/8” thick vinyl gasket and supported by a heavy ¼” wall 6063 T6 aluminum frame. Official white border and target area is fused to the glass during the tempering process with fritt ceramic paint.

G. Cushioned Edge Pad:

1. Basis-of-Design Product: Subject to compliance with requirements, provide ADP Lemco Inc.; Model 105 Cushioned Edge Pad or comparable product by one of the following:
    a. AALCO Manufacturing.
    b. Draper Inc.
    c. Spalding Equipment.
2. Mounting: Bolt-on attachment
3. Color: Selected by Architect from Manufacturer’s full range.

H. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern that is manufacturer's standard for goal attachment.

1. Glass Backboard Goal Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backboard frame and to minimize stresses on glass backboard.
2. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard, and rigidity and stability of goal are maximized.
3. Provide metal split ring escutcheon where horizontal supports penetrate MDF panels and where support penetrate masonry veneer. Paint escutcheons black.

I. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.

1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication per manufacturer's standard design.
2. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
3. Field Adjustment: Provide rim that is field-adjustable for rebound elasticity without being removed from the backboard.
4. Mount: Rear.
5. Net Attachment: No-tie loops for attaching net to rim without tying.
6. Finish: Manufacturer's standard finish.

J. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit rim diameter, and as follows:

1. Competition Cord: Antiwhip, made from white nylon cord not less than 120-gm thread and not more than 144-gm thread.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for use and finish type 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.
2. Steel Tubing: ASTM A 500/A 500M or ASTM A 513, cold formed.
3. Steel Sheet: ASTM A 1011/A 1011M.

C. Castings and Hangers: Malleable iron, complying with ASTM A 47/A 47M; grade required for structural loading.

D. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed.

E. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C 1107/C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, and other conditions affecting performance of the Work.

1. Verify critical dimensions.

2. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions. Complete equipment field assembly where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.

C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.

D. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.

3.3 CLEANING

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 11 66 23

SECTION 11 68 00 - PLAY FIELD EQUIPMENT AND 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 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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide GameTime; GT Events & PowerScape, or comparable product by one of the following:

a. Landscape Structures Inc.
b. Play & Park Structures

C. GT Events System General: The uprights shall be factory drilled to ensure accurate placement of components and ease of installation. Field drilling and measuring are not required. GT Events are direct bolt products NOT a clamp system. All uprights shall receive factory installed aluminum post caps and shall be shipped with a factory applied label indicating proper surfacing level. All decks and components shall connect to support posts by means of a through-bolt connection for strong, durable connections. Deck/Collar attachments shall not be acceptable.

1. Climbers:

a. Mini Pod Toadstool: The Mini Pod shall be rotational molded from polyethylene. The polyethylene shall be linear low-density material with UV-stabilized color and an anti-static compound additive. All rotational molded products shall meet or exceed the following specifications: ASTM D-1248, type 2, class A and Federal specification LP-390C, type 1, class M, grade 2, category 3; Density (ASTM D-155); Brittleness Temperature (ASTM D-746); Tensile Values (ASTM D-638); Flexural Modulus (ASTM D-790); Heat Distortion (ASTM-648); Low Temperature Impact (ARM-STD).

1) Frame: Shall be an all-welded assembly fabricated of 2.375" O.D. galvanized steel tubing with a wall thickness of .095" and 12 gauge (.109") hot rolled flat steel that is formed. This assembly shall have a powder coat finish.
2) Extension: Shall be fabricated of 1.9" O.D. galvanized steel tubing with a wall thickness of .095"
3) Plug: Shall be fabricated of black butyl rubber with a durometer of 60.
4) Hardware: All nuts, bolts, screws, inserts, and lock washers used in the assembly of all play equipment, shall be stainless steel, yellow dichromate plated steel, blue-coat plated steel, mechanically galvanized or powder coated/yellow dichromate plated steel. All primary fasteners shall be 300 series stainless steel.
5) Fasteners with yellow dichromate treatment have an electro deposited, 99.9% pure zinc substrate applied from a specially formulated solution sealed with a yellow dichromate top coat designed to work in conjunction with the zinc plating. Yellow dichromate has a 320% longer life to white corrosion and 275% longer to red corrosion than does hot-dip galvanizing.

D. PowerScape General: 5" O.D. uprights with a positive bolt-through fastening system. The uprights shall be factory drilled to ensure accurate placement of components and ease of installation. Field drilling and measuring are not required. Direct bolt systems are preferred.

Clamp systems are not allowed. All uprights shall receive factory installed aluminum post caps and shall be shipped with a factory applied label indicating proper surfacing level.

1. Decks & Components: All decks and components shall connect to support posts by means of a through-bolt connection for strong, durable connections. Deck/Collar attachments shall not be acceptable. All climbing attachments shall include a 15" wide deck entryway or archway to control deck access to one child at a time and help prevent inadvertent falls.

2. Uprights & Upright Accessories:

    a. Upright Connection: Connector shall incorporate an aluminum casting in a distinctive purpose mounting system that allows a rung panel to mount to the upright. The connector will have a matching counterpart for flat panel connections. Each is bolted directly into the upright post through a factory located and installed connection and designed to eliminate protrusions. Each shall be die cast of 380 aluminum alloy, to resist corrosion. Minimum tensile strength shall be 45,000 psi, minimum yield strength shall be 22,000 psi. All connectors shall be coated with a custom formula of TGIC polyester powder coating, in conformance with the specifications outlined herein.

    b. Uprights, Aluminum: Shall be 5"outside diameter tubing, 1/8" wall thickness, extruded from 6005-T5 aluminum alloy conforming to ASTM-B-221. Minimum yield strength shall be 35,000 psi and minimum tensile strength shall be 38,000 psi. All upright posts shall have a finished grade line marking to indicate the correct playground safety surface level. All upright posts shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

    c. Uprights, Steel: Shall be 5" outside diameter, 11 gauge (.120") galvanized round tubing, manufactured to ASTM A-500 Grade B tolerances from cold-formed steel conforming to ASTM A-569 Sheet Spec for steel coil. Minimum yield strength shall be 50,000 psi and minimum tensile strength shall be 55,000 psi. The exterior surface is hot dip galvanized, chromate conversion coated, and a clear high performance organic polymer is applied. The inside diameter has 81% minimum zinc rich primer capable of providing excellent rust protection and fabrication characteristics. All coatings are applied inside and out after welding for superior corrosion protection throughout. Exterior surface galvanizing zinc purity is 99% as per ASTM B-6 high grade and special high grade. Galvanizing coverage shall demonstrate the ability to exceed 1000 hours salt spray corrosion exposure in accordance with ASTM B-117. Internal surface zinc rich 81% minimum zinc dust content in organic resin, as per ASTM F-1234, Section 5.2.4, Type D. All upright posts shall have a finished grade line marking to indicate the correct playground safety surface level. All upright posts shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

    d. Upright Caps: The standard upright cap shall be an aluminum cap, cast from a 383 alloy, powder coated to match the upright. Every upright cap shall receive a primer coat for maximum protection. All upright caps are permanently installed at the factory using aluminum self-sealing rivets.

3. Punched Steel & Coated Deck Components:

a. Punched Steel Decks and PVC Coated Components: All punched steel products shall be fabricated from 11 gauge punched steel with a protective p&o finish. Coated products shall consist of a welded assembly with an oven cured matte finish polyvinyl chloride (PVC) coating with a minimum coating thickness of .080". All decks shall be dipped with an extra thick coating on the top of the deck. The PVC coating shall have a hardness of Shore A 83 +/-5 normal durometer range. This material is classed as "Self-Extinguishing", meets, or exceeds automotive specifications NVSS302, and contains ultraviolet inhibitors to help prolong the life of the coating. The PVC coating shall contain pthalate levels in concentrations of 1/10 of 1% or lower. For ADA Ramp Accessible decks and ramps, the hole shall measure 1/4" diameter after coating. For standard decks and ramps, the hole size shall measure 1 1/4" diameter after coating.

b. Decks, Square: Shall have a minimum surface area of 2,381 square inches, maintaining a full 49" center to center spacing on the upright posts. The 49" square deck shall be fabricated in conformance with the punched steel specifications outlined herein. The deck frame shall be fabricated from 3/16" x 3-1/2" hot rolled steel with corner supports fabricated from 1/4" x 3-1/2" hot rolled steel. Intermediate supports, fabricated from 1/8" x 2-1/2" hot rolled steel, shall be notched, and welded at the intersections forming a rigid 12" support grid underneath the entire deck surface. The deck shall be a one-piece welded assembly, coated after fabrication with an oven cured matte finish polyvinyl chloride (PVC) coating in accordance with the specifications herein. The square deck shall be directly bolted to the upright posts with eight 3/8" diameter button-pin-in-head, hex socket cap screws in accordance with the hardware specifications herein.

c. Transfer System: The transfer system shall be made from 11 gauge punched steel with a protective P&O finish in conformance with the specifications outlined herein. The transfer system shall be a one-piece welded assembly finished with the matte PVC coating per the specifications herein. Handrails and attachment rails shall be fabricated from 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing, with supports fabricated from 1-1/16" O.D. x 15 gauge (.075" thick) galvanized steel tubing and 2" square x 3/16" wall steel tubing. Handholds, and attachment rails shall be all-welded assemblies and shall be coated after fabrication with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein.

4. Roofs & Arches:

a. Slate / Shingle Roof with Eave: The roof eave shall bolt directly to the four uprights and shall be one-piece, double-wall rotationally molded linear low-density polyethylene conforming to the specifications outlined herein. The Slate and Shingle Roofs shall bolt directly to the roof base and shall be one-piece, double-wall rotationally molded linear low-density polyethylene conforming to the specifications outlined herein.

5. Climbers:

a. Schooner Climber: The Schooner Climber shall be fabricated from 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing with horizontal members fabricated of 1-1/16" O.D. x .075" (15 gauge) wall galvanized steel tubing and a mounting plate fabricated from 3/16" thick stainless steel. The ladder assembly shall be an all-welded construction and shall be coated with a custom formula of TGIC

polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Schooner Climber shall include an Offset Entry Archway or entryway in accordance with the specifications herein.

b. Stego Climber: Stego climber shall be a one-piece weld assembly with a center rail fabricated from 2 3/8" O.D. x .095" wall steel tubing. The formed step rung shall be fabricated from 1 5/16" O.D. x .083" wall steel tubing. the mounting plate shall be fabricated from 3/16" x 18" hot rolled steel. A custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

c. Ridge Climber: The Ridge Climber shall be constructed from impregnated linear low-density polyethylene and shall conform to the rotationally molded specifications outlined herein. The mounting bracket shall be fabricated of 1/4" x 1" hot rolled steel. The foot buck shall be fabricated from 1 5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing. The mounting bracket, and foot buck assemblies shall be coated with a custom formula of TGIC polyester powder, after fabrication in conformance with the specifications outlined herein.

6. Upper Body Development Components:

a. Crunch Bar: Shall be fabricated from 1-1/16" O.D. x .075"(15 gauge) wall galvanized steel tubing and shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

7. Panels:

a. Bongos: The Bongos are molded from a color impregnated linear low-density polyethylene and shall conform to the rotationally molded specifications outlined herein.

b. Hand Cycler: The Hand Cycler frame shall be an all-welded assembly fabricated from 1 ½" O.D. LW galvanized steel tubing and 1" O.D. LW galvanized steel tubing with 3/16" thick stainless-steel tabs. The Hand Cycler frame shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein. The Hand Cycler disks shall be constructed of two 3/4" thick (2 color) high density, UV-stabilized and color impregnated polyethylene. The disks shall ride on three 1 ½" molded urethane skate wheels.

8. Slides:

a. Zip Slides (Single & Double Bedway, And Rumble & Roll): Zip Slides and hoods shall be color impregnated linear low-density polyethylene and shall conform to the rotationally molded specifications outlined herein with double wall construction molded to a minimum .25" wall thickness. Single bedway Zip Slides shall have a minimum inside bed width of 17.5" while double bedway Zip Slides shall have a minimum inside bed width of 16.5" on each bedway. Outside rails are at least 7" high when measured from the centerline of the bedway surface. The angle of descent shall be no greater than 50°. Each Zip Slide works in conjunction with a rotationally molded hood that has an integrated cross bar which force users to a seated position. The exit section of the bedway shall have a minimum 40" radius for a smooth transition from the slide chute to the run-out area. The run-out shall

be angled at a maximum of 4° with an integrated drain at 5° to reduce pooling of water. Zip Slides bolt directly to the deck and to the slide hood.

2.2 PLAY FIELD STRUCTURES – 1st – 3rd 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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide GameTime; GT Events, Xscape, PowerScape, & PowerScape Plus, or comparable product by one of the following:

1. Landscape Structures Inc.
2. Play & Park Structures

C. GT Events System General: The uprights shall be factory drilled to ensure accurate placement of components and ease of installation. Field drilling and measuring are not required. GT Events are direct bolt products NOT a clamp system. All uprights shall receive factory installed aluminum post caps and shall be shipped with a factory applied label indicating proper surfacing level. All decks and components shall connect to support posts by means of a through-bolt connection for strong, durable connections. Deck/Collar attachments shall not be acceptable.

1. Climbers:

a. Mini Pod Toadstool: The Mini Pod shall be rotational molded from polyethylene. The polyethylene shall be linear low-density material with UV-stabilized color and an anti-static compound additive. All rotational molded products shall meet or exceed the following specifications: ASTM D-1248, type 2, class A and Federal specification LP-390C, type 1, class M, grade 2, category 3; Density (ASTM D-155); Brittleness Temperature (ASTM D-746); Tensile Values (ASTM D-638); Flexural Modulus (ASTM D-790); Heat Distortion (ASTM-648); Low Temperature Impact (ARM-STD).

1) Frame: Shall be an all-welded assembly fabricated of 2.375" O.D. galvanized steel tubing with a wall thickness of .095" and 12 gauge (.109") hot rolled flat steel that is formed. This assembly shall have a powder coat finish.
2) Extension: Shall be fabricated of 1.9" O.D. galvanized steel tubing with a wall thickness of .095"
3) Plug: Shall be fabricated of black butyl rubber with a durometer of 60.
4) Hardware: All nuts, bolts, screws, inserts, and lock washers used in the assembly of all play equipment, shall be stainless steel, yellow dichromate plated steel, blue-coat plated steel, mechanically galvanized or powder coated/yellow dichromate plated steel. All primary fasteners shall be 300 series stainless steel.
5) Fasteners with yellow dichromate treatment have an electro deposited, 99.9% pure zinc substrate applied from a specially formulated solution sealed with a yellow dichromate topcoat designed to work in conjunction with the zinc plating. Yellow dichromate has a 320% longer life to white corrosion and 275% longer to red corrosion than does hot-dip galvanizing.

D. PowerScape Plus System General: PowerScape® Plus features 5" O.D. uprights with a positive bolt-through PowerLock fastening system. The uprights shall be factory drilled to ensure accurate placement of components and ease of installation. Field drilling and measuring are not required. PowerScape® Plus is a direct bolt system NOT a clamp system. All uprights shall receive factory installed aluminum post caps and shall be shipped with a factory applied label indicating proper surfacing level. All decks and components shall connect to support posts by means of a through-bolt connection for strong, durable connections. Deck/Collar attachments shall not be acceptable. All climbing attachments shall include a 15"" wide deck entry archway to control deck access to one child at a time and help prevent inadvertent falls.

1. Punched Steel & Coated Components: All punched steel products shall be fabricated from 12 gauge punched steel with a protective p&o finish. Coated products shall consist of a welded assembly with an oven cured matte finish polyvinyl chloride (PVC) coating with a minimum coating thickness of .080". All decks shall be exclusively dipped utilizing the DuraWear process with an extra thick coating on the top of the deck. The PVC coating shall have a hardness of Shore A 83 +/-5 normal durometer range. This material is classed as "Self-Extinguishing", meets or exceeds automotive specifications NVSS302, and contains ultraviolet inhibitors to help prolong the life of the coating. The PVC coating shall contain pthalate levels in concentrations of 1/10 of 1% or lower. For ADA Ramp Accessible decks and ramps, the hole shall measure 1/4" diameter after coating. For standard decks and ramps, the hole size shall measure 1 1/4" diameter after coating.

2. Decks, Triangular: Shall have a minimum surface area of 1,039 square inches, maintaining a full 49" center to center spacing on the upright posts. The triangular platform shall be fabricated in conformance with the punched steel specifications outlined herein. The deck frame shall be fabricated from 3/16" x 3-1/2" hot rolled steel with corner supports fabricated from 1/4" x 3-1/2" hot rolled steel. Intermediate supports, fabricated from 1/8" x 2-1/2" hot rolled steel, shall be welded at the intersections forming a rigid support grid underneath the deck surface. The deck shall be a one-piece welded assembly, coated after fabrication with an oven cured matte finish polyvinyl chloride (PVC) coating in accordance with the specifications herein. Each triangular deck shall be directly bolted to the upright posts with six 3/8" diameter button-pin-in-head, hex socket cap screws in accordance with the hardware specifications herein.

E. Xscape System General: Xscape consists of Climbing Walls which utilize formed 3 ½" O. D. Galvanized Pipe Frames with a variety of different climbing inserts placed in the frames. These inserts include metal and High-Density Polyethylene construction. The Links and Overheads consist of weldments, Roto-Mold and High-Density Polyethylene elements for climbing and play. There are Circuits and Connectors which are welded assemblies allowing for multiple configurations. The Freestanding Components construction is the same as listed above. All components of this product have plates that bolt together to insure accurate placement of components and ease of installation. Field drilling and measuring are not required.

1. Materials:

a. Powder Coat Finish: Shall be an electrostatically applied custom formula of TGIC polyester powder. All components will be free of sharp edges and excess weld spatter and shall be cleaned in a four-stage solvent / zirconium-based bath system (free of iron phosphate), as a rust inhibitor, and a zirconium conversion coating to prevent flash rusting before coating. In addition, all welds shall be protectively coated with ZRP, a zinc rich primer that forms a rust-resistant barrier layer over each weld prior to application of the powder coating. The powder coating shall have a super tough finish with maximum exterior durability and will have superior

adhesion characteristics. Typical characteristics are: Two coat process to achieve 3.0 - 5.0 mil thickness and oven cured between 350 degrees Fahrenheit. Pencil Hardness H (ASTM D-3363), Impact (ASTM D-2794- 69), Wedge Bend (ASTM D-522-68), Adhesion (Cross Hatch ASTM D-3359 & Knife Scratch ASTM D-2197), Environmental (Stain Resistance ASTM D-1308, Humidity ASTM D-2247 - 87, Salt Spray ASTM B-117 & Fadometer 300 hrs with no loss of gloss), Over-bake Stability 100% at 350 degrees Fahrenheit for 10 minutes.

b. Rotationally Molded Products: All polyethylene shall be linear low-density material with UV-stabilized color and an anti-static compound additive. All rotationally molded products shall meet or exceed the following specifications: ASTM D-1248, type 2, class A and Federal specification LP-390C, type 1, class M, grade 2, category 3; Density (ASTM D- 1505); Brittleness Temperature (ASTM D-746); Tensile Values (ASTM D-638); Flexural Modulus (ASTM D-790); Heat Distortion (ASTM-648); Low Temperature Impact (ARM-STD).

c. Triangular Shroud: The Triangular Shroud shall be molded from EPDM 90-Durometer.

2. Connectors & Supports:

a. X-Pod Step: The X-Pod Step socket shall be fabricated from 3.5" outside diameter, 13 gauge (.095") galvanized round tubing with a pod mounting plate made from 3/16" thick hot rolled steel plate. The X-Pod Step center post shall be fabricated from 3.5" o.d, 13 gauge (.095") galvanized round tubing with a ring weld assembly fabricated from 1" L.W. galv. pipe with 1.029 o.d. galv. pipe support members and 1.66" O.D. x .083" (14 gauge) galvanized pipe. The horizontal pipes shall be made from 2" LW galv. pipe with a 6" o.d. ball. The triangle mounting plates are constructed from 3/16" x 4 ½" stainless steel. The X-Pod Step socket and center post shall be all welded assemblies and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The rotomolded step shall be color impregnated linear low-density polyethylene and shall conform to the rotationally molded specifications outlined herein with double wall construction molded to a minimum .25" wall thickness. The X-Pod Step surface shall be cast of EPDM of durometer 90.

b. Ps+ Single Link Cross Beam: The PowerScape Plus Single Link Crossbeam shall be fabricated from 2 3/8" O.D. x .095" wall galvanized steel tubing, 3/16" flat stainless steel mounting tabs, and 3/16" formed stainless steel tabs. The PowerScape Plus Single Link Crossbeam shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

3. Overhead:

a. Stretched Loop Ladder: The Stretched Loop Ladder shall be fabricated from 2 3/8" O.D. SCH 40 x .13" (10 gauge) galvanized round pipe. The mounting plate is constructed from 3/16" x 4 1/2" stainless steel. The loops shall be fabricated from 1-1/16" O.D. x .072" (15 gauge) wall galvanized steel tubing. The ladder assembly shall be an all-welded construction and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

b. Arched Loop Ladder: The Arched Loop Ladder shall be fabricated from rolled 2 3/8" O.D. x .165" (8 gauge) galvanized round pipe. The mounting plate is constructed from 3/16" x 4 1/2" stainless steel. The loops shall be fabricated from

1-1/16" O.D. x .072" (15 gauge) wall galvanized steel tubing. The ladder assembly shall be an all-welded construction and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

4. Attachment:

a. Bubble Climbing Wall: The Bubble Climbing Wall shall be fabricated from rolled 3.5" outside diameter, 13 gauge (.095") galvanized round tubing, 2 3/8" O.D. x .095" (13 gauge) galvanized pipe, 2 3/8" O.D. SCH 40 x .13" (10 gauge) galvanized pipe, and 1 5/16" O.D. x .083" (14 gauge) galvanized steel tubing. The tabs are constructed from 3/16" stainless steel. The Bubble Climbing Wall assembly shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Bubble panel shall be made from 3/4" thick (solid) high density, UV-stabilized, laminated and color impregnated polyethylene. The Wall Topper shall be molded from EPDM 70-Durometer.

b. Sail Climbing Wall: The Sail Climbing Wall shall be fabricated from rolled 3.5" outside diameter, 13 gauge (.095") galvanized round tubing, 2 3/8" O.D. x .095" (13 gauge) galvanized pipe, and 2 3/8" O.D. SCH 40 x .13" (10 gauge) galvanized pipe. The climbing rails shall be 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing. The top mounting plate is constructed from 3/16" x 4 1/2" stainless steel. The Sail Climbing Wall assembly shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Wall Topper shall be molded from EPDM 70-Durometer.

F. PowerScape: PowerScape® features 5" O.D. uprights with a positive bolt-through TRU-LOC fastening system. The uprights shall be factory drilled to ensure accurate placement of components and ease of installation. Field drilling and measuring are not required. PowerScape® is a direct bolt system NOT a clamp system. All uprights shall receive factory installed aluminum post caps and shall be shipped with a factory applied label indicating proper surfacing level. All decks and components shall connect to support posts by means of a through-bolt connection for strong, durable connections. Deck/Collar attachments shall not be acceptable. All climbing attachments shall include a 15" wide deck entryway or archway to control deck access to one child at a time and help prevent inadvertent falls.

1. Materials:

a. Hardware: All nuts, bolts, screws, inserts, and lockwashers used in the assembly of all play equipment shall be stainless steel, yellow dichromate plated steel, blue-coat plated steel, mechanically galvanized or powder coated/yellow dichromate plated steel. All primary fasteners shall be 304 alloy stainless steel. Fasteners with yellow dichromate treatment have an electro-deposited, 99.9% pure zinc substrate applied from a specially formulated solution sealed with a yellow dichromate topcoat designed to work in conjunction with the zinc plating. Yellow dichromate has a 320% longer life to white corrosion and 275% longer to red corrosion than does hot-dip galvanizing. PowerScape Plus stainless-steel fasteners shall be button pin-in head, hex socket cap screws with a two-part epoxy locking patch added to the threads. The two-part locking patch shall consist of one part resin and one part catalyst which are activated during installation. After curing, the material shall require a minimum of five times the installation torque to remove the fastener. Manufacturer shall provide special installation tools for pinned fasteners.

b. Powder Coat Finish: Shall be an electrostatically applied custom formula of TGIC polyester powder. All components will be free of sharp edges and excess weld spatter and shall be cleaned in a four-stage solvent / zirconium-based bath system (free of iron phosphate), as a rust inhibitor, and a zirconium conversion coating to prevent flash rusting before coating. In addition, all welds shall be protectively coated with ZRP, a zinc rich primer that forms a rust-resistant barrier layer over each weld prior to application of the powder coating. The powder coating shall have a super tough finish with maximum exterior durability and will have superior adhesion characteristics. Typical characteristics are: Two coat process to achieve 3.0 - 5.0 mil thickness and oven cured between 350 degrees Fahrenheit. Pencil Hardness H (ASTM D-3363), Impact (ASTM D-2794- 69), Wedge Bend (ASTM D-522-68), Adhesion (Cross Hatch ASTM D-3359 & Knife Scratch ASTM D-2197), Environmental (Stain Resistance ASTM D-1308, Humidity ASTM D-2247 - 87, Salt Spray ASTM B-117 & Fadometer 300 hrs with no loss of gloss), Over-bake Stability 100% at 350 degrees Fahrenheit for 10 minutes.

c. Rotationally Molded Products: All polyethylene shall be linear low-density material with UV-stabilized color and an anti-static compound additive. All rotationally molded products shall meet or exceed the following specifications: ASTM D-1248, type 2, class A and Federal specification LP-390C, type 1, class M, grade 2, category 3; Density (ASTM D- 1505); Brittleness Temperature (ASTM D-746); Tensile Values (ASTM D-638); Flexural Modulus (ASTM D-790); Heat Distortion (ASTM-648); Low Temperature Impact (ARM-STD).

d. Metal Guardrail Entryway: The Guardrail Entryway shall be fabricated of 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing and a 3/16" Hot Rolled Mounting Tab. The Guardrail Entryway shall be an all-welded assembly and shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

e. Metal Barrier Entryway: The Barrier Entryway shall be fabricated of 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing and a 3/16" Hot Rolled Mounting Tab. The vertical rungs shall be fabricated of 1-1/16" O.D. x .075" (15 gauge) wall galvanized steel tubing. The Barrier Entryway shall be an all-welded assembly and shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

f. Metal Barrier Archway W/ Socket: The Barrier Archway w/Socket shall be fabricated of 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing, 1-5/8" O.D. x .083" (14 gauge) wall galvanized steel tubing, 1/8"Hot Rolled Steel Gussets, and 3/16" Hot Rolled Mounting Tabs. The vertical rungs shall be fabricated of 1-1/16" O.D. x .075" (15 gauge) wall galvanized steel tubing. The Barrier Archway W/Socket shall be an all-welded assembly and shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

2. Uprights & Upright Accessories:

a. Upright Connection: Connector shall incorporate an aluminum casting in a distinctive purpose mounting system that allows a rung panel to mount to the upright. The connector will have a matching counterpart for flat panel connections. Each is bolted directly into the upright post through a factory located and installed connection and designed to eliminate protrusions. Each shall be die cast of 380 aluminum alloy, to resist corrosion. Minimum tensile strength shall be 45,000 psi, minimum yield strength shall be 22,000 psi. All connectors shall be coated with a custom formula of TGIC polyester powder coating, in conformance with the specifications outlined herein.

b. Uprights, Aluminum: Shall be 5"outside diameter tubing, 1/8" wall thickness, extruded from 6005-T5 aluminum alloy conforming to ASTM-B-221. Minimum yield strength shall be 35,000 psi and minimum tensile strength shall be 38,000 psi. All upright posts shall have a finished grade line marking to indicate the correct playground safety surface level. All upright posts shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

c. Uprights, Steel: Shall be 5" outside diameter, 11 gauge (.120") galvanized round tubing, manufactured to ASTM A-500 Grade B tolerances from cold-formed steel conforming to ASTM A-569 Sheet Spec for steel coil. Minimum yield strength shall be 50,000 psi and minimum tensile strength shall be 55,000 psi. The exterior surface is hot dip galvanized, chromate conversion coated, and a clear high performance organic polymer is applied. The inside diameter has 81% minimum zinc rich primer capable of providing excellent rust protection and fabrication characteristics. All coatings are applied inside and out after welding for superior corrosion protection throughout. Exterior surface galvanizing zinc purity is 99% as per ASTM B-6 high grade and special high grade. Galvanizing coverage shall demonstrate the ability to exceed 1000 hours salt spray corrosion exposure in accordance with ASTM B-117. Internal surface zinc rich 81% minimum zinc dust content in organic resin, as per ASTM F-1234, Section 5.2.4, Type D. All upright posts shall have a finished grade line marking to indicate the correct playground safety surface level. All upright posts shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

d. Upright Caps: The standard upright cap shall be an aluminum cap, cast from a 383 alloy, powder coated to match the upright. Every upright cap shall receive a primer coat for maximum protection. All upright caps are permanently installed at the factory using aluminum self-sealing rivets.

3. Punched Steel & Coated Deck Components:

a. Punched Steel Decks and PVC Coated Components: All punched steel products shall be fabricated from 11 gauge punched steel with a protective p&o finish. Coated products shall consist of a welded assembly with an oven cured matte finish polyvinyl chloride (PVC) coating with a minimum coating thickness of .080". All decks shall be dipped with an extra thick coating on the top of the deck. The PVC coating shall have a hardness of Shore A 83 +/-5 normal durometer range. This material is classed as "Self-Extinguishing", meets, or exceeds automotive specifications NVSS302, and contains ultraviolet inhibitors to help prolong the life of the coating. The PVC coating shall contain pthalate levels in concentrations of 1/10 of 1% or lower. For ADA Ramp Accessible decks and ramps, the hole shall measure 1/4" diameter after coating. For standard decks and ramps, the hole size shall measure 1 1/4" diameter after coating.

b. Decks, Square: Shall have a minimum surface area of 2,381 square inches, maintaining a full 49" center to center spacing on the upright posts. The 49" square deck shall be fabricated in conformance with the punched steel specifications outlined herein. The deck frame shall be fabricated from 3/16" x 3-1/2" hot rolled steel with corner supports fabricated from 1/4" x 3-1/2" hot rolled steel. Intermediate supports, fabricated from 1/8" x 2-1/2" hot rolled steel, shall be notched, and welded at the intersections forming a rigid 12" support grid underneath the entire deck surface. The deck shall be a one-piece welded assembly, coated after fabrication with an oven cured matte finish polyvinyl chloride (PVC) coating in accordance with the specifications herein. The square deck shall be directly bolted to the upright posts with eight 3/8" diameter button-

pin-in-head, hex socket cap screws in accordance with the hardware specifications herein.

c. Transfer System: The transfer system shall be made from 11 gauge punched steel with a protective P&O finish in conformance with the specifications outlined herein. The transfer system shall be a one-piece welded assembly finished with the matte PVC coating per the specifications herein. Handrails and attachment rails shall be fabricated from 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing, with supports fabricated from 1-1/16" O.D. x 15 gauge (.075" thick) galvanized steel tubing and 2" square x 3/16" wall steel tubing. Handholds, and attachment rails shall be all-welded assemblies and shall be coated after fabrication with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein.

d. Triangle Transfer Platform: The Triangle Transfer Platform shall consist of triangle deck and modular deck that shall both be fabricated of 12 Ga. (.109") P.&O. Hot RolledFlat Galvanealed Steel and finished with the matte PVC coating per the specifications herein. The kickplates shall be fabricatedof 11Ga. (.1233") Hot Rolled Flat Galvannealed Steel and finished with the matte PVC coating per the specifications herein. The Handrail shall be all welded assembly. The formed tab for the handrail shall be fabricated from 3/16" x 1/12" Hot Rolled Steel. The pipe for the handrail shall be fabricated from1.315" O.D. x .083" wall galvanized steel pipe. The handrail shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein. The support pipe shall be all welded assembly. The support pipe shall be fabricated from from1.315" O.D. x .083" wall galvanized steel pipe. The end cap shall be fabricated from 14 Ga. galvanneal steel. The support pipe shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

4. Roofs & Arches:

a. Slate / Shingle Roof with Eave: The Roof Eave shall bolt directly to the four uprights and shall be one-piece, double-wall rotationally molded linear low-density polyethylene conforming to the specifications outlined herein. The Slate and Shingle Roofs shall bolt directly to the Roof Base and shall be one-piece, double-wall rotationally molded linear low-density polyethylene conforming to the specifications outlined herein.

5. Bridges:

a. Funnel Bridge: The bridge sections shall be fabricated from punched steel in conformance with the specifications outlined herein. Each bridge section shall be a one- piece welded assembly finished with the matte PVC coating per the specifications herein. The bridge frame shall be fabricated from 11-gauge x 3-1/2" hot rolled steel with the intermediate supports fabricated from 1/8" x 1" hot rolled steel. Funnel bridge protective barriers shall be an all-welded construction of a formed 1-5/8" O.D. x .083" (14 gauge) wall galvanized steel tubing and 1-1/16" O.D. x .075" (15 gauge) wall galvanized steel tubing vertical rungs. The protective barrier assembly shall be coated with a custom formula of TGIC polyester powder, after fabrication in conformance with the specifications outlined herein.

b. Mini-Arch Bridge: The bridge section shall be fabricated from punched steel in conformance with the specifications outlined herein. The bridge section shall be a one-piece welded assembly finished with the matte PVC coating per the specifications herein. The bridge frame shall be fabricated from 3/16" x 3-1/2" and

1/4" x 3-1/2" hot rolled steel. Mini-Arch bridge protective or guardrail barriers shall be an all-welded construction of a formed 1-5/8" O.D. x .083" (14 gauge) wall galvanized steel tubing and 1-1/16" O.D. x .075" (15 gauge) wall galvanized steel tubing vertical rungs. The protective barrier or guardrail assembly shall be coated, after fabrication, with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein.

6. Climbers:

   a. Wavy Climber: Wavy climber shall be a one-piece welded assembly with the center rail fabricated from 2-3/8" O.D. x .095" (13 gauge) wall galvanized steel tubing. The climbing rungs shall be fabricated from 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing. Mounting bracket shall be fabricated from 3/16" x 3-1/2" hot rolled flat steel with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.
   b. Spiral Step Climber: Spiral Step climber shall be a one-piece weld assembly with a center rail fabricated from 1 21/32" O.D. x .083" wall galvanized steel tubing. The handrail shall be fabricated from1 1/32" O.D. x .072" wall galvanized steel tubing. The step plates shall be fabricated from 10 Gauge hot rolled steel. the support pipe for the step shall be fabricated from 1 21/32" O.D. x .083" wall galvanized steel tubing. A custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein. The step shall be fabricated from 3/4" HDPE.
   c. Pod Climber: The Pod Climber shall be rotational molded from polyethylene. The polyethylene shall be linear low-density material with UV-stabilized color and an anti-static compound additive. All rotational molded products shall meet or exceed the following specifications: ASTM D-1248, type 2, class A and Federal specification LP-390C, type 1, class M, grade 2, category 3; Density (ASTM D-155); Brittleness Temperature (ASTM D-746); Tensile Values (ASTM D-638); Flexural Modulus (ASTM D-790); Heat Distortion (ASTM-648); Low Temperature Impact (ARM-STD).

      1) Frame: Shall be an all-welded assembly fabricated of 2.375" O.D. galvanized steel tubing with a wall thickness of .095" and 12 gauge (.109") hot rolled flat steel that is formed. This assembly shall have a powder coat finish.
      2) Extension: Shall be fabricated of 1.9" O.D. galvanized steel tubing with a wall thickness of .095"
      3) Plug: Shall be fabricated of black butyl rubber with a durometer of 60.
      4) Hardware: All nuts, bolts, screws, inserts, and lock washers used in the assembly of all play equipment, shall be stainless steel, yellow dichromate plated steel, blue-coat plated steel, mechanically galvanized or powder coated/yellow dichromate plated steel. All primary fasteners shall be 300 series stainless steel. Fasteners with yellow dichromate treatment have an electro deposited, 99.9% pure zinc substrate applied from a specially formulated solution sealed with a yellow dichromate topcoat designed to work in conjunction with the zinc plating. Yellow dichromate has a 320% longer life to white corrosion and 275% longer to red corrosion than does hot-dip galvanizing.

7. Slides:

   a. Zip Slides (Single & Double Bedway, And Rumble & Roll): Zip Slides and hoods shall be color impregnated linear low-density polyethylene and shall conform to the rotationally molded specifications outlined herein with double wall construction

molded to a minimum .25" wall thickness. Single bedway Zip Slides shall have a minimum inside bed width of 17.5" while double bedway Zip Slides shall have a minimum inside bed width of 16.5" on each bedway. Outside rails are at least 7" high when measured from the centerline of the bedway surface. The angle of descent shall be no greater than 50°. Each Zip Slide works in conjunction with a rotationally molded hood that has an integrated cross bar which force users to a seated position. The exit section of the bedway shall have a minimum 40" radius for a smooth transition from the slide chute to the run-out area. The run-out shall be angled at a maximum of 4° with an integrated drain at 5° to reduce pooling of water. Zip Slides bolt directly to the deck and to the slide hood.

b. Swerve Slides (Single & Double): Swerve Slides and hoods shall be color impregnated linear low-density polyethylene and shall conform to the rotationally molded specifications outlined herein with double wall construction molded to a minimum .25" wall thickness. Single bedway Swerve Slides shall have a minimum inside bed width of 17.5" while double bedway Swerve Slides shall have a minimum inside bed width of 16.5" on each bedway. Outside rails are at least 7" high when measured from the centerline of the bedway surface. The angle of descent shall be no greater than 50°. Each Swerve Slide works in conjunction with a rotationally molded hood that has an integrated cross bar which force users to a seated position. The exit section of the bedway shall have a minimum 40" radius for a smooth transition from the slide chute to the run-out area. The run-out shall be angled at a maximum of 4° with an integrated drain at 5° to reduce pooling of water. Swerve Slides bolt directly to the deck and to the slide hood.

2.3 PLAY FIELD STRUCTURES – 4th – 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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide GameTime; Xscape & PowerScape, or comparable product by one of the following:

1. Landscape Structures Inc.
2. Play & Park Structures

C. Xscape System General: Xscape consists of Climbing Walls which utilize formed 3 ½" O. D. Galvanized Pipe Frames with a variety of different climbing inserts placed in the frames. These inserts include metal and High-Density Polyethylene construction. The Links and Overheads consist of weldments, Roto-Mold and High-Density Polyethylene elements for climbing and play. There are Circuits and Connectors which are welded assemblies allowing for multiple configurations. The Freestanding Components construction is the same as listed above. All components of this product have plates that bolt together to insure accurate placement of components and ease of installation. Field drilling and measuring are not required.

1. Materials:

a. Powder Coat Finish: Shall be an electrostatically applied custom formula of TGIC polyester powder. All components will be free of sharp edges and excess weld spatter and shall be cleaned in a four-stage solvent / zirconium-based bath system (free of iron phosphate), as a rust inhibitor, and a zirconium conversion coating to prevent flash rusting before coating. In addition, all welds shall be protectively coated with ZRP, a zinc rich primer that forms a rust-resistant barrier layer over each weld prior to application of the powder coating. The powder coating shall

have a super tough finish with maximum exterior durability and will have superior adhesion characteristics. Typical characteristics are: Two coat process to achieve 3.0 - 5.0 mil thickness and oven cured between 350 degrees Fahrenheit. Pencil Hardness H (ASTM D-3363), Impact (ASTM D-2794- 69), Wedge Bend (ASTM D-522-68), Adhesion (Cross Hatch ASTM D-3359 & Knife Scratch ASTM D-2197), Environmental (Stain Resistance ASTM D-1308, Humidity ASTM D-2247 - 87, Salt Spray ASTM B-117 & Fadometer 300 hrs with no loss of gloss), Over-bake Stability 100% at 350 degrees Fahrenheit for 10 minutes.

b. Rotationally Molded Products: All polyethylene shall be linear low-density material with UV-stabilized color and an anti-static compound additive. All rotationally molded products shall meet or exceed the following specifications: ASTM D-1248, type 2, class A and Federal specification LP-390C, type 1, class M, grade 2, category 3; Density (ASTM D- 1505); Brittleness Temperature (ASTM D-746); Tensile Values (ASTM D-638); Flexural Modulus (ASTM D-790); Heat Distortion (ASTM-648); Low Temperature Impact (ARM-STD).

c. Triangular Shroud: The Triangular Shroud shall be molded from EPDM 90-Durometer.

2. Connectors & Supports:

a. X-Pod Step: The X-Pod Step socket shall be fabricated from 3.5" outside diameter, 13 gauge (.095") galvanized round tubing with a pod mounting plate made from 3/16" thick hot rolled steel plate. The X-Pod Step center post shall be fabricated from 3.5" o.d, 13 gauge (.095") galvanized round tubing with a ring weld assembly fabricated from 1" L.W. galv. pipe with 1.029 o.d. galv. pipe support members and 1.66" O.D. x .083" (14 gauge) galvanized pipe. The horizontal pipes shall be made from 2" LW galv. pipe with a 6" o.d. ball. The triangle mounting plates are constructed from 3/16" x 4 ½" stainless steel. The X-Pod Step socket and center post shall be all welded assemblies and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The rotomolded step shall be color impregnated linear low-density polyethylene and shall conform to the rotationally molded specifications outlined herein with double wall construction molded to a minimum .25" wall thickness. The X-Pod Step surface shall be cast of EPDM of durometer 90.

3. Connectors & Supports:

a. 2-Way Support Link: The 2-Way Support Link shall be fabricated from rolled 3.5" outside diameter, 13 gauge (.095") galvanized round tubing. The center hub is constructed from a center cross pipe of 2" SCH 40 Galvanized pipe with 2 3/8" O.D. x .095" (13 gauge) galvanized pipe sockets. The mounting plates are constructed of 3/16" x 4 ½" stainless steel. The Support Link shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Single Post Topper shall be molded from EPDM 70-Durometer.

b. X-Pod Step: The X-Pod Step socket shall be fabricated from 3.5" outside diameter, 13 gauge (.095") galvanized round tubing with a pod mounting plate made from 3/16" thick hot rolled steel plate. The X-Pod Step center post shall be fabricated from 3.5" o.d, 13 gauge (.095") galvanized round tubing with a ring weld assembly fabricated from 1" L.W. galv. pipe with 1.029 o.d. galv. pipe support members and 1.66" O.D. x .083" (14 gauge) galvanized pipe. The horizontal pipes shall be made from 2" LW galv. pipe with a 6" o.d. ball. The triangle mounting plates are constructed from 3/16" x 4 ½" stainless steel. The X-Pod Step socket and center

post shall be all welded assemblies and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The rotomolded step shall be color impregnated linear low-density polyethylene and shall conform to the rotationally molded specifications outlined herein with double wall construction molded to a minimum .25" wall thickness. The X-Pod Step surface shall be cast of EPDM of durometer 90.

4. Overhead:

   a. Arched Trapeze Ring: The Arched Trapeze Ring top rail shall be fabricated from rolled 2 3/8" O.D. x .165" (8 gauge) galvanized round pipe. The mounting plate is constructed from 3/16" x 4 1/2" stainless steel. The top rail shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The trapeze rings shall be cast from exceedingly strong, light, heat, and rust-resistant aluminum alloy. A steel grommet shall be press-inserted into the trapeze ring to add strength and reduce wear.
   b. Stretched Loop Ladder: The Stretched Loop Ladder shall be fabricated from 2 3/8" O.D. SCH 40 x .13" (10 gauge) galvanized round pipe. The mounting plate is constructed from 3/16" x 4 1/2" stainless steel. The loops shall be fabricated from 1-1/16" O.D. x .072" (15 gauge) wall galvanized steel tubing. The ladder assembly shall be an all-welded construction and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.
   c. Arched Loop Ladder: The Arched Loop Ladder shall be fabricated from rolled 2 3/8" O.D. x .165" (8 gauge) galvanized round pipe. The mounting plate is constructed from 3/16" x 4 1/2" stainless steel. The loops shall be fabricated from 1-1/16" O.D. x .072" (15 gauge) wall galvanized steel tubing. The ladder assembly shall be an all-welded construction and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

5. Connectors:

   a. Ps+ Single Link Cross Beam: The PowerScape Plus Single Link Crossbeam shall be fabricated from 2 3/8" O.D. x .095" wall galvanized steel tubing, 3/16" flat stainless steel mounting tabs, and 3/16" formed stainless steel tabs. The PowerScape Plus Single Link Crossbeam shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

6. Attachment:

   a. Bubble Climbing Wall: The Bubble Climbing Wall shall be fabricated from rolled 3.5" outside diameter, 13 gauge (.095") galvanized round tubing, 2 3/8" O.D. x .095" (13 gauge) galvanized pipe, 2 3/8" O.D. SCH 40 x .13" (10 gauge) galvanized pipe, and 1 5/16" O.D. x .083" (14 gauge) galvanized steel tubing. The tabs are constructed from 3/16" stainless steel. The Bubble Climbing Wall assembly shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Bubble panel shall be made from 3/4" thick (solid) high density, UV-stabilized, laminated and color impregnated polyethylene. The Wall Topper shall be molded from EPDM 70-Durometer.

b. Laced Climbing Wall: The Laced Climbing Wall shall be fabricated from rolled 3.5" outside diameter, 13 gauge (.095") galvanized round tubing, 2 3/8"O.D. x .095" (13 gauge) galvanized pipe, and 2 3/8" O.D. SCH 40 x .13" (10 gauge) galvanized pipe. The climbing rails shall be 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing. The top mounting plate is constructed from 3/16" x 4 1/2" stainless steel. The Laced climbing wall assembly shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Wall Topper shall be molded from EPDM 70-Durometer.

c. Oval Climbing Wall: The Oval Climbing Wall shall be fabricated from rolled 3.5" outside diameter, 13 gauge (.095") galvanized round tubing, 2 3/8" O.D. x .095" (13 gauge) galvanized pipe, and 2 3/8" O.D. SCH 40 x .13" (10 gauge) galvanized pipe. The tabs are constructed from 3/16" stainless steel. The Oval Climbing Wall assembly shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Oval panel shall be made from 3/4" thick (solid) high density, UV-stabilized, laminated and color impregnated polyethylene. The Wall Topper shall be molded from EPDM 70-Durometer.

d. Rock Climbing WalL: The Rock-Climbing Wall shall be fabricated from rolled 3.5" outside diameter, 13 gauge (.095") galvanized round tubing. 2 3/8" O.D. x .095" (13 gauge) galvanized pipe, and 2 3/8" O.D. SCH 40 x .13" (10 gauge) galvanized pipe. The tabs are constructed from 3/16" stainless steel. The Rock-Climbing Wall assembly shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Rock panel shall be made from 3/4" thick (solid) high density, UV-stabilized, laminated and color impregnated polyethylene. The Grips are four organic variations injection molded of polyethylene. The Wall Topper shall be molded from EPDM 70-Durometer.

e. Sail Climbing Wall: The Sail Climbing Wall shall be fabricated from rolled 3.5" outside diameter, 13 gauge (.095") galvanized round tubing, 2 3/8" O.D. x .095" (13 gauge) galvanized pipe, and 2 3/8" O.D. SCH 40 x .13" (10 gauge) galvanized pipe. The climbing rails shall be 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing. The top mounting plate is constructed from 3/16" x 4 1/2" stainless steel. The Sail Climbing Wall assembly shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Wall Topper shall be molded from EPDM 70-Durometer.

7. Attachment 2 to 5:

a. Fun Seat: The Fun Seat frame shall be fabricated from rolled 3.5" outside diameter, 13-gauge (.095") galvanized round tubing, 2 3/8" O.D. x .095" (13 gauge) galvanized pipe, 1-5/16" O.D. x .083" (14 gauge) wall galvanized pipe and 1" O.D. x .072" (15 gauge) wall galvanized pipe. The mounting plate is constructed from 3/16" x 4 1/2" stainless steel. The handrail shall be fabricated from 1-5/16" O.D. x .083" (14 gauge) wall galvanized pipe. The Fun Seat Wall assembly shall be an all-welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The Fun Seat shall be a one-piece, rotationally molded linear low-density polyethylene piece conforming to the specifications outlined herein. The Wall Topper shall be molded from EPDM 70-Durometer.

D. PowerScape: PowerScape® features 5" O.D. uprights with a positive bolt-through TRU-LOC fastening system. The uprights shall be factory drilled to ensure accurate placement of

components and ease of installation. Field drilling and measuring are not required. PowerScape® is a direct bolt system NOT a clamp system. All uprights shall receive factory installed aluminum post caps and shall be shipped with a factory applied label indicating proper surfacing level. All decks and components shall connect to support posts by means of a through-bolt connection for strong, durable connections. Deck/Collar attachments shall not be acceptable. All climbing attachments shall include a 15" wide deck entryway or archway to control deck access to one child at a time and help prevent inadvertent falls.

1. Materials:

    a. Hardware: All nuts, bolts, screws, inserts, and lockwashers used in the assembly of all play equipment shall be stainless steel, yellow dichromate plated steel, blue-coat plated steel, mechanically galvanized or powder coated/yellow dichromate plated steel. All primary fasteners shall be 304 alloy stainless steel. Fasteners with yellow dichromate treatment have an electro-deposited, 99.9% pure zinc substrate applied from a specially formulated solution sealed with a yellow dichromate topcoat designed to work in conjunction with the zinc plating. Yellow dichromate has a 320% longer life to white corrosion and 275% longer to red corrosion than does hot-dip galvanizing. PowerScape Plus stainless-steel fasteners shall be button pin-in head, hex socket cap screws with a two-part epoxy locking patch added to the threads. The two-part locking patch shall consist of one part resin and one part catalyst which are activated during installation. After curing, the material shall require a minimum of five times the installation torque to remove the fastener. Manufacturer shall provide special installation tools for pinned fasteners.
    b. Powder Coat Finish: Shall be an electrostatically applied custom formula of TGIC polyester powder. All components will be free of sharp edges and excess weld spatter and shall be cleaned in a four-stage solvent / zirconium-based bath system (free of iron phosphate), as a rust inhibitor, and a zirconium conversion coating to prevent flash rusting before coating. In addition, all welds shall be protectively coated with ZRP, a zinc rich primer that forms a rust-resistant barrier layer over each weld prior to application of the powder coating. The powder coating shall have a super tough finish with maximum exterior durability and will have superior adhesion characteristics. Typical characteristics are: Two coat process to achieve 3.0 - 5.0 mil thickness and oven cured between 350 degrees Fahrenheit. Pencil Hardness H (ASTM D-3363), Impact (ASTM D-2794- 69), Wedge Bend (ASTM D-522-68), Adhesion (Cross Hatch ASTM D-3359 & Knife Scratch ASTM D-2197), Environmental (Stain Resistance ASTM D-1308, Humidity ASTM D-2247 - 87, Salt Spray ASTM B-117 & Fadometer 300 hrs with no loss of gloss), Over-bake Stability 100% at 350 degrees Fahrenheit for 10 minutes.
    c. Rotationally Molded Products: All polyethylene shall be linear low-density material with UV-stabilized color and an anti-static compound additive. All rotationally molded products shall meet or exceed the following specifications: ASTM D-1248, type 2, class A and Federal specification LP-390C, type 1, class M, grade 2, category 3; Density (ASTM D- 1505); Brittleness Temperature (ASTM D-746); Tensile Values (ASTM D-638); Flexural Modulus (ASTM D-790); Heat Distortion (ASTM-648); Low Temperature Impact (ARM-STD).
    d. Metal Guardrail Entryway: The Guardrail Entryway shall be fabricated of 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing and a 3/16" Hot Rolled Mounting Tab. The Guardrail Entryway shall be an all-welded assembly and shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.
    e. Metal Barrier Entryway: The Barrier Entryway shall be fabricated of 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing and a 3/16" Hot Rolled Mounting Tab. The vertical rungs shall be fabricated of 1-1/16" O.D. x .075" (15 gauge) wall

galvanized steel tubing. The Barrier Entryway shall be an all-welded assembly and shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

f. Metal Barrier Archway W/ Socket: The Barrier Archway w/Socket shall be fabricated of 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing, 1-5/8" O.D. x .083" (14 gauge) wall galvanized steel tubing, 1/8"Hot Rolled Steel Gussets, and 3/16" Hot Rolled Mounting Tabs. The vertical rungs shall be fabricated of 1-1/16" O.D. x .075" (15 gauge) wall galvanized steel tubing. The Barrier Archway W/Socket shall be an all-welded assembly and shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

2. Uprights & Upright Accessories:

a. Upright Connection: Connector shall incorporate an aluminum casting in a distinctive purpose mounting system that allows a rung panel to mount to the upright. The connector will have a matching counterpart for flat panel connections. Each is bolted directly into the upright post through a factory located and installed connection and designed to eliminate protrusions. Each shall be die cast of 380 aluminum alloy, to resist corrosion. Minimum tensile strength shall be 45,000 psi, minimum yield strength shall be 22,000 psi. All connectors shall be coated with a custom formula of TGIC polyester powder coating, in conformance with the specifications outlined herein.

b. Uprights, Aluminum: Shall be 5"outside diameter tubing, 1/8" wall thickness, extruded from 6005-T5 aluminum alloy conforming to ASTM-B-221. Minimum yield strength shall be 35,000 psi and minimum tensile strength shall be 38,000 psi. All upright posts shall have a finished grade line marking to indicate the correct playground safety surface level. All upright posts shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

c. Uprights, Steel: Shall be 5" outside diameter, 11 gauge (.120") galvanized round tubing, manufactured to ASTM A-500 Grade B tolerances from cold-formed steel conforming to ASTM A-569 Sheet Spec for steel coil. Minimum yield strength shall be 50,000 psi and minimum tensile strength shall be 55,000 psi. The exterior surface is hot dip galvanized, chromate conversion coated, and a clear high performance organic polymer is applied. The inside diameter has 81% minimum zinc rich primer capable of providing excellent rust protection and fabrication characteristics. All coatings are applied inside and out after welding for superior corrosion protection throughout. Exterior surface galvanizing zinc purity is 99% as per ASTM B-6 high grade and special high grade. Galvanizing coverage shall demonstrate the ability to exceed 1000 hours salt spray corrosion exposure in accordance with ASTM B-117. Internal surface zinc rich 81% minimum zinc dust content in organic resin, as per ASTM F-1234, Section 5.2.4, Type D. All upright posts shall have a finished grade line marking to indicate the correct playground safety surface level. All upright posts shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

d. Upright Caps: The standard upright cap shall be an aluminum cap, cast from a 383 alloy, powder coated to match the upright. Every upright cap shall receive a primer coat for maximum protection. All upright caps are permanently installed at the factory using aluminum self-sealing rivets.

3. Punched Steel & Coated Deck Components:

a. Punched Steel Decks and PVC Coated Components: All punched steel products shall be fabricated from 11 gauge punched steel with a protective p&o finish. Coated products shall consist of a welded assembly with an oven cured matte finish polyvinyl chloride (PVC) coating with a minimum coating thickness of .080". All decks shall be dipped with an extra thick coating on the top of the deck. The PVC coating shall have a hardness of Shore A 83 +/-5 normal durometer range. This material is classed as "Self-Extinguishing", meets, or exceeds automotive specifications NVSS302, and contains ultraviolet inhibitors to help prolong the life of the coating. The PVC coating shall contain pthalate levels in concentrations of 1/10 of 1% or lower. For ADA Ramp Accessible decks and ramps, the hole shall measure 1/4" diameter after coating. For standard decks and ramps, the hole size shall measure 1 1/4" diameter after coating.

b. Decks, Square: Shall have a minimum surface area of 2,381 square inches, maintaining a full 49" center to center spacing on the upright posts. The 49" square deck shall be fabricated in conformance with the punched steel specifications outlined herein. The deck frame shall be fabricated from 3/16" x 3-1/2" hot rolled steel with corner supports fabricated from 1/4" x 3-1/2" hot rolled steel. Intermediate supports, fabricated from 1/8" x 2-1/2" hot rolled steel, shall be notched, and welded at the intersections forming a rigid 12" support grid underneath the entire deck surface. The deck shall be a one-piece welded assembly, coated after fabrication with an oven cured matte finish polyvinyl chloride (PVC) coating in accordance with the specifications herein. The square deck shall be directly bolted to the upright posts with eight 3/8" diameter button-pin-in-head, hex socket cap screws in accordance with the hardware specifications herein.

c. Transfer System: The transfer system shall be made from 11 gauge punched steel with a protective P&O finish in conformance with the specifications outlined herein. The transfer system shall be a one-piece welded assembly finished with the matte PVC coating per the specifications herein. Handrails and attachment rails shall be fabricated from 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing, with supports fabricated from 1-1/16" O.D. x 15 gauge (.075" thick) galvanized steel tubing and 2" square x 3/16" wall steel tubing. Handholds, and attachment rails shall be all-welded assemblies and shall be coated after fabrication with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein.

d. Triangle Transfer Platform: The Triangle Transfer Platform shall consist of triangle deck and modular deck that shall both be fabricated of 12 Ga. (.109") P.&O. Hot RolledFlat Galvanealed Steel and finished with the matte PVC coating per the specifications herein. The kickplates shall be fabricatedof 11Ga. (.1233") Hot Rolled Flat Galvannealed Steel and finished with the matte PVC coating per the specifications herein. The Handrail shall be all welded assembly. The formed tab for the handrail shall be fabricated from 3/16" x 1/12" Hot Rolled Steel. The pipe for the handrail shall be fabricated from1.315" O.D. x .083" wall galvanized steel pipe. The handrail shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein. The support pipe shall be all welded assembly. The support pipe shall be fabricated from from1.315" O.D. x .083" wall galvanized steel pipe. The end cap shall be fabricated from 14 Ga. galvanneal steel. The support pipe shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

E. Roofs & Arches:

1. Arch Bridge: The bridge sections shall be fabricated from punched steel in conformance with the specifications outlined herein. Each bridge section shall be a one- piece welded assembly finished with the matte PVC coating per the specifications herein. The bridge frame shall be fabricated from 3/16" x 3-1/2" and 1/4" x 3-1/2" hot rolled steel with the intermediate supports fabricated from 1/8" x 3" hot rolled steel. Arch bridge protective barriers shall be an all-welded construction of a formed 1-5/8" O.D. x .083" (14 gauge) wall galvanized steel tubing and 1-1/16" O.D. x .075" (15 gauge) wall galvanized steel tubing vertical rungs. The protective barrier assembly shall be coated with a custom formula of TGIC polyester powder, after fabrication in conformance with the specifications outlined herein.
2. Mini-Arch Bridge: The bridge section shall be fabricated from punched steel in conformance with the specifications outlined herein. The bridge section shall be a one-piece welded assembly finished with the matte PVC coating per the specifications herein. The bridge frame shall be fabricated from 3/16" x 3-1/2" and 1/4" x 3-1/2" hot rolled steel. Mini-Arch bridge protective or guardrail barriers shall be an all-welded construction of a formed 1-5/8" O.D. x .083" (14 gauge) wall galvanized steel tubing and 1-1/16" O.D. x .075" (15 gauge) wall galvanized steel tubing vertical rungs. The protective barrier or guardrail assembly shall be coated, after fabrication, with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein.

F. Climbers:

1. Loop Ladders: The loop ladder side rails shall be fabricated from 1-5/8" O.D. x .083" (14 gauge) wall galvanized steel tubing. The loops shall be fabricated from 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing. The ladder assembly shall be an all-welded construction and shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein. The PowerScape loop ladder shall include an entry archway or entryway in accordance with the specifications herein.
2. Trunk Climber: The Upper Climber assembly shall be an all-welded one-piece construction from 3/16" (.188") hot rolled steel, 1-5/16" x 14-gauge (.083") wall and from 1-7/8" O.D. by .095" (13 gauge) wall galvanized tubing. The Side and Center Supports assembly shall be an all-welded one-piece construction from 1-7/8" O.D. by .095" (13 gauge) wall galvanized tubing and 3/16" (.188") hot rolled steel. The Bottom Rungs are from 1-7/8" O.D. by .095" (13 gauge) wall galvanized tubing and threaded inserts in each end. The Deck Rungs are from 1-5/16" x 14-gauge (.083") wall galvanized tubing. All the parts are powder coated after fabrication with a custom formula of TGIC polyester in conformance with the specifications outlined herein.
3. Wavy Climber: Wavy climber shall be a one-piece welded assembly with the center rail fabricated from 2-3/8" O.D. x .095" (13 gauge) wall galvanized steel tubing. The climbing rungs shall be fabricated from 1-5/16" O.D. x .083" (14 gauge) wall galvanized steel tubing. Mounting bracket shall be fabricated from 3/16" x 3-1/2" hot rolled flat steel with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.
4. Stego Climber: Stego climber shall be a one-piece weld assembly with a center rail fabricated from 2 3/8" O.D. x .095" wall steel tubing. The formed step rung shall be fabricated from 1 5/16" O.D. x .083" wall steel tubing. the mounting plate shall be fabricated from 3/16" x 18" hot rolled steel. A custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.
5. Pod Climber: The Pod Climber shall be rotational molded from polyethylene. The polyethylene shall be linear low-density material with UV-stabilized color and an anti-static compound additive. All rotational molded products shall meet or exceed the following specifications: ASTM D-1248, type 2, class A and Federal specification LP-390C, type 1, class M, grade 2, category 3; Density (ASTM D-155); Brittleness

Temperature (ASTM D-746); Tensile Values (ASTM D-638); Flexural Modulus (ASTM D-790); Heat Distortion (ASTM-648); Low Temperature Impact (ARM-STD).

a. Frame: Shall be an all-welded assembly fabricated of 2.375" O.D. galvanized steel tubing with a wall thickness of .095" and 12 gauge (.109") hot rolled flat steel that is formed. This assembly shall have a powder coat finish.
b. Extension: Shall be fabricated of 1.9" O.D. galvanized steel tubing with a wall thickness of .095"
c. Plug: Shall be fabricated of black butyl rubber with a durometer of 60.
d. Hardware: All nuts, bolts, screws, inserts, and lock washers used in the assembly of all play equipment, shall be stainless steel, yellow dichromate plated steel, blue-coat plated steel, mechanically galvanized or powder coated/yellow dichromate plated steel. All primary fasteners shall be 300 series stainless steel.
e. Fasteners with yellow dichromate treatment have an electro deposited, 99.9% pure zinc substrate applied from a specially formulated solution sealed with a yellow dichromate topcoat designed to work in conjunction with the zinc plating. Yellow dichromate has a 320% longer life to white corrosion and 275% longer to red corrosion than does hot-dip galvanizing.

6. Scramble Up Climber: Scramble Up climber shall be a one-piece weld assembly with the main rail fabricated from 1 1/16" O.D. x .072" wall galvanized steel tubing. The straight tab shall be fabricated from 1/8" hot rolled steel. The formed mounting tab shall be fabricated from 3/16. The scramble up weld assembly shall be coated with a custom formula of The scramble up panel shall be fabricated from 3/4" thick (solid) high density, UV-stabilized, laminated and color impregnated polyethylene. TGIC polyester powder coating in conformance with the specifications outlined herein. The formed tab for panel attachment shall be fabricated from 1/8" hot rolled steel and coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

G. Upper Body Development Components:

1. Crunch Bar: Shall be fabricated from 1-1/16" O.D. x .075"(15 gauge) wall galvanized steel tubing and shall be coated after fabrication with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein.

H. Panels:

1. Fun Seat: Shall be one piece construction manufactured from linear low-density polyethylene material and shall conform to the rotationally molded specifications outlined herein. The Seat Frame Weld Ass'y shall be fabricated from 1-5/16" O.D. x .083" (14 gauge) wall, 1-1/16" O.D. x .072" (15 gauge) wall galvanized steel tubing and 3/16" stainless steel mounting tabs. The Seat Frame Weld Ass'y shall be al welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

I. Slides:

1. Zip Slides (Single & Double Bedway, And Rumble & Roll): Zip Slides and hoods shall be color impregnated linear low-density polyethylene and shall conform to the rotationally molded specifications outlined herein with double wall construction molded to a minimum .25" wall thickness. Single bedway Zip Slides shall have a minimum inside bed width of 17.5" while double bedway Zip Slides shall have a minimum inside bed width of 16.5" on each bedway. Outside rails are at least 7" high when measured from the centerline of the bedway surface. The angle of descent shall be no greater than 50°. Each Zip Slide

works in conjunction with a rotationally molded hood that has an integrated cross bar which force users to a seated position. The exit section of the bedway shall have a minimum 40" radius for a smooth transition from the slide chute to the run-out area. The run-out shall be angled at a maximum of 4° with an integrated drain at 5° to reduce pooling of water. Zip Slides bolt directly to the deck and to the slide hood.

2.4 BASKETBALL GOALS

A. Products: Subject to compliance with requirements, available 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 Bison Inc., PR52 Gooseneck Basketball Pole/Goal or comparable product by one of the following:

1. Athletic Connection
2. First Team Inc.

C. Materials:

1. Pole: Pole shall be constructed of 4 1/2" outside diameter RS40 flow coated galvanized steel tubing with a 7 ga. wall thickness. Design shall be a bent gooseneck style and allow for a 48" bury into the ground and a 48" extension from the front of the pole to the face of the backboard. Two 1 5/8" diameter 13 ga. flow coated galvanized tubular braces shall support the top of the backboard and connect directly to the pole. Pole shall be designed so that the rim mounts directly to the horizontal pole section through the backboard to eliminate stress on the backboard during play. Pole systems without backboard support braces shall not be considered equal.
2. Backboard: Backboard shall be constructed of cast aluminum with a 35 ½” x 54" fan-shaped playing surface. The minimum playing surface thickness shall be 3/16". A minimum of 35" of support ribs shall be cast into the rear of the backboard. Total thickness of the backboard shall be 1 ½” The backboard shall be coated with a white textured polyester powder coated finish and have an official size orange shooter's square and border.
3. Rim: Rim shall consist of two 5/8" diameter AISI 1018 cold drawn carbon steel rings welded together at a minimum of six places. Back and side plates shall be 3/16" thick and be continuously welded. The net attachment system shall be of a continuous type constructed of 3/16" x 1" steel with punched net attachment slots suitable for nylon (included) or chain (optional) nets. Individual or continuous wire formed netlocks are not an acceptable equal. Rim shall be punched to mount on any front mount backboard. Mounting hardware shall be included.

D. Warranty:

1. Pole: 25 Years
2. Backboard: Limited lifetime warranty.
3. Rim: Unconditional lifetime warranty.

E. Weight: 235 pounds or more.

F. Hardware: Manufacturer’s mounting hardware shall be included.

G. Installation & mounting per manufacturer’s instructions.

2.5 TETHERBALL POLES

A. Products: Subject to compliance with requirements, available 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 Steelcraft Products, Tetherball Assembly LA-TBPCB, or comparable product by one of the following:

1. Total Tetherball
2. Bison Inc.

C. Materials:

1. Pole: One-piece 2 3/8-inch Galvanized Steel Post

   a. Height: 11'-8"

2. Eye: 3/8 inch welded to post.
3. Cap: Welded galvanized.
4. Markings:
   a. 2" wide red foul band painted @ 6' above grade on post.
   b. Court markings as indicated on site plan.
5. Swivel: 5/8-inch harness snap.
6. Chain: 3/16-inch galvanized chain.

   a. Length: 38 inches.

7. Ball: Butyl rubber tetherball with rope.

D. Installation & mounting per manufacturer's instructions.

2.6 BICYCLE RACKS.

A. Products: Subject to compliance with requirements, available 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 Treetop Products Park-It Bike Racks 7YT7066 or comparable product by one of the following:
1. Cora Bike Rack.
2. Creative Pipe, Inc.
3. Dero Bike Rack Co.
4. GameTime; a PlayCore, Inc. company.
5. Miracle Recreation Equipment Co.; a division of PlayPower, Inc.

C. Bicycle Rack Construction:
1. Frame: Galvanized steel.
   a. Pipe OD: Not less than 1-5/8 inches.
2. Style: Double-side parking.
   a. Overall Width: 111.5 inches.
   b. Capacity: Designed to accommodate no fewer than 18 bicycles.
3. Installation Method: Surface mount to concrete substrate with tamper resistant fasteners.

D. Steel Finish: Galvanized.

2.7 SKATEBOARD RACKS.

A. Products: Subject to compliance with requirements, available 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 TapCo In-Ground Skateboard Rack SKU 116205 or approved equal.

C. Skateboard Rack Construction:
1. Frame: Galvanized steel, 4” OD axle locking tube, 2” square tube legs.
2. Style: Double-side parking.
   a. Capacity: Designed to accommodate no fewer than 8 skateboards.
3. Installation Method: Surface flange anchored at finished grade to concrete substrate with tamper resistant fasterners.

D. Steel Finish: Painted – Color to be selected by Architect.

2.8 FUN BALL GOAL

A. Products: Subject to compliance with requirements, available 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 Playcraft Systems, Triple Hoop Fun Ball Goal PC-1809, or comparable product.

C. Materials:
1. Pole: 3.5” O.D. galvanized steel tubing.
2. Cap & plugs: high density 3/4" sheet plastic specially formulated for optimum UV stability and color retention.
3. Triple Hoop Goal: UV-stabilized, rotationally molded, linear, low density polyethylene with an average wall thickness of .250".
4. Hardware: Stainless steel as required to resist rust & corrosion. Tamper resistant hardware shall be used for all principal connections.
5. Installation & mounting per manufacturer’s instructions.

2.9 SKATE STOPS

A. For locations on concrete benches:
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 Intellicept, Skate Stop FR0.5, or comparable product.
2. Materials:
   a. Material: 6061-T6 Aluminum
   b. Finish: Type II Clear Anodized Hard Anodized
3. Spacing: 18” from end of planters, wall & benches and 36” O.C. max. or centered between control joints.
4. Installation & mounting per manufacturer’s instructions.

B. For locations at guardrails and handrails:
   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 TAPCO “HR” series, or comparable product.
   2. Materials:
      a. Material: Cast Aluminum
      b. Finish: Type II Clear Anodized Hard Anodized
   3. Spacing: 18” from end of rails and 30” O.C. max. along railings.
   4. Installation & mounting per manufacturer’s instructions.

2.10 UNITED STATES MAP

A. Provide painted United States map, measuring approximately 38’-0” x 24’-0” (excluding Alaska & Hawaii).
   1. Map boundaries and state lines shall be solid lines, as described in Part 3 Execution, Playground Markings.

2.11 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.

2.12 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.

2.13 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.

2.14 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.

2.15 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.

2.16 ATHLETIC COURT AND PLAYGROUND MARKING PAINT

A. Includes Bus lineup indicator markings.

B. Paint: Water emulsion-based traffic paint.

1. Dunn Edwards
2. ICI Paints
3. Fine Line Paint Corporation
4. PAR Paint Company
5. Pervo Paint Company
6. Sherwin Williams
7. Vista Paint Corporation
8. Cal Western Paints

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 INSTALLATION, TETHERBALL POLE

A. Locate the center of the court. Footing per Drawings. Place the post in the footing and support in a plumb and level position. Place concrete into the footing hole and ensure that the top of the footing slopes away from the post for drainage. Allow concrete to cure per Section 03 30 00 - “Cast-in-Place Concrete” prior to attaching rope and ball.

3.5 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.

3.6 PLAYGROUND MARKINGS

A. Application of Paint:

1. Prior to application of paint, allow the pavement to properly cure. Clean and prepare in accordance with paint manufacturer's written recommendations.
2. Provide mechanical equipment to install paint in a uniform, straight or curved pattern, without holidays and other defects.
3. Do not permit traffic until paint has completely cured.
4. Install 2 coats in thickness recommended by manufacturer or a minimum of 11 mils, whichever is more stringent.

B. Marking Width and Color: Unless indicated otherwise, marking width and color are as follows:

1. Athletic Court Lines: Solid lines, 2 inches wide, color: White
2. U.S. Map Lines: Solid lines, 1 inch wide, color: White.

END OF SECTION 11 68 00

SECTION 11 82 26 – WASTE COMPACTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes waste compactors.

B. Related Sections:

1. Division 11 Section “Foodservice Equipment” for waste compactors in food service facilities.
2. Division 26 Sections for electrical service conditions.

1.3 DEFINITIONS

A. WASTEC Rating: The volume of waste material in the charging chamber moved by the ram within the compactor in a single stroke.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Coordination Drawings: Drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Roughing-in dimensions, service connection details, and locations of field connections.
2. Required clearances for equipment service and operation.
3. Setting drawings, templates, and directions for installing anchor bolts and other anchorages.

C. Qualification Data: For Installer.

D. Maintenance Data: For waste compactors to include in maintenance manuals. In addition to items specified in Division 01 Section “Operation and Maintenance Data”, include the following:

1. Operating and maintenance instructions.
2. Parts inventory list.
3. Purchase source for operating and maintenance materials.
4. Emergency information.
5. Name, address, and telephone number of manufacturer’s service representative whose location is nearest Project site.

1.5 QUALITY ASSURANCE

A. Installers Qualifications: Manufacturer’s authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than three hours normal travel time from Installer's place of business to Project site.

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.

C. Waste Compactor Standards: Comply with ANSI Z245.2 and with NFPA 82.

D. Waste Bin and Hopper Standard: Comply with ANSI Z245.30.

1.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of waste compactor installer.

1. Schedule regular surveillance and preventative maintenance visits at 30-day intervals for one year.
2. Repair or replace worn or defective components; lubricate, clean and adjust equipment as required for proper equipment operation. Use replacement parts and maintenance supplies that were used in the manufacture and installation of the original equipment.

PART 2 - PRODUCTS

2.1 WASTE COMPACTORS

A. Basis-of-Design Product: Model SC-T1-15 "Cram-A-Lot" by J.V. Manufacturing, Inc., P.O. Box 229, Springdale, AR 72765-0229, (800) 678.7320.

1. Minimum WASTEC Rating Base Size: .75 cu. yd.
2. Minimum Infeed Opening: 31 x 48 inches.
3. Charge Box Capacity: 1 cu. yd.
4. Normal/Maximum System Pressures: 2000/2400 psi (13.8/16.5 MPa).
5. Ram Face: 48" w. x 23" h.
6. Ram Penetration: 6 inches (152 mm) min.
7. Normal/Maximum Packing Forces: 40,600/48,800 lbf.
8. Normal/Maximum Force Ratings: 36.8/44.2 psi.
9. Normal Cycle Time: 39 seconds.
10. Unit Weight: 7,000 lbs.
11. Motor: 10 hp 480v, 3 phase.
12. Controls: Manufacturer's standard.
13. Pump capacity: 10.5 gpm.
14. Hydraulic Reservoir Capacity: 22 gal.
15. Hydraulic Cylinder: Bore – (2) 4", Stroke – 26", Rod – 2".
16. Construction: Container Sides and Floor – 10-gauge steel, Understructure Rails – 3116 tubing, Breaker Bar – 6" x 6" x 1" angle, Compactor Floor – 1/2" plate, Ram Top and Sides – 3/16" plate, Ram Bottom – 1/2" AR plate.
17. Normal Container Capacity: 15 cu. yds.
18. Provide steel channel guide rails and stops.
19. Understructure to be configured to be compatible with local disposal/hauler service vehicles.

a. Contact:
Waste Management of Nevada, 100 Vassar Street, Reno, NV 89502.

Kim Fleming, Franchise Account Manager, (530)-520-9722 kflemin1@wm.com

20. Hopper side door facing control station.
21. Open-top hopper.
22. Provide side-mounted cart-tipper.

a. Cart-tipper shall be configured to accept Akro-Mils “Akro-Cart” #76490 – Medium-duty 90 gal cart without lid. Contractor shall be responsible for coordinating cart-tipper configuration.
b. Carts will be provided by Owner.
c. Akro-Mils Inc., 1554 S. Main St., Akron, OH 44301, (800) 253-2467, www.akro-mils.com

2.2 FABRICATION

A. Fabricate waste compactors with smooth, eased exposed edges.

B. Fabricate bins, hoppers, chutes, compaction chambers, unit bodies, and similar components of steel plate with welded joints. Reinforce with structural-steel members sized and spaced to withstand impacts and pressures of normal operations and to prevent excessive long-term development of waves and valleys.

C. Fabricate equipment with replaceable parts at points of normal wear.

D. Provide electrical devices, controls, and materials of type and quality recommended by NEMA for applications indicated. See Division 16 Sections for power characteristics and service to equipment, including disconnect switches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, clearance requirements, service rough-ins, and other conditions affecting performance or Work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Set waste compactors level, plumb, properly aligned, and securely in place. Anchor as required for secure operation.

B. Complete field assembly with adjoining methods recommended in writing by manufacturer.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain waste compactors. Refer to Division 01 Section “Demonstration and Training”.

END OF SECTION 11 82 26

SECTION 12 24 12 – MOTORIZED ROLLER SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roller shades, motorized operation, and accessories for Transaction Window.
   1. Intelligent encoded electronic drive system
   2. Motor controls, interfaces, and accessories.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.

B. Section 09 21 16 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.

C. Section 09 51 00 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.

D. Division 26 - Electrical: Electric service for motor controls.

1.3 REFERENCES

A. ASTM International (ASTM):
   1. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   2. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

C. Underwriters Laboratories (UL):
   1. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
   2. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

D. Window Covering Manufacturers Association (WCMA):
   1. WCMA A100.1 - Safety of Window Covering Products; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
   2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
   2. Do not install shades until the final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   3. Storage and handling requirements and recommendations.
   4. Mounting details and installation methods.
   5. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
   1. Prepare shop drawings on Autocad or Microstation format using base sheets provided electronically by the Architect.

D. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

F. Warranty: Provide manufacturer’s warranty documents as specified in this Section.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642,

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.9 WARRANTY

A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.

C. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five year warranty.

D. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For motor operators and control systems to include in operation and maintenance manuals.

B. Warranty: For manufacturer's executed warranty documentation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Mecho, which is located at: 42-03 35th St.; Long Island City, NY 11101; Tel: 512-348-0962; Fax: 718-729-2941; Email: mason.biggi@mechoshade.com; Web:http://www.mechoshade.com , or a comparable product by another manufacturer.

2.2 ROLLER SHADE TYPE AND SHADECLOTH

A. Motorized Shades:
1. Motorized Shade System:
a. ElectroShade with WhisperShade IQ2 EDU (120V)
b. Shade Type: Single Roller.
a. Mounting: Wall Mounted with fascia
c. Drop Position: Regular roll.

d. Blackout Shadecloths:
1) Fabric: Chelsea: 0250 series. Opaque.
2) Color: Selected from manufacturer's standard colors.
e. Hembars: Maintains bottom of shade straight and flat.
1) Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
f. Accessories:
a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
1) Finish: Baked enamel.
2) Color: White.
3) Profile: Square.
g. System Capabilities:
1) Line Voltage EDU (120 VAC):
a) Basis of Design: MechoShade Systems LLC; WhisperShadeIQ2 System. Tubular, asynchronous, integral AC motor and reversible capacitor. 120 VAC, single phase, 60 Hz; temperature Class B,

thermally-protected, totally enclosed, maintenance-free. Powered by line voltage power supply connection equipped with locking disconnect plug assembly furnished with EDU.

b) Audible Noise: 46 dBA measured 3 ft (914 mm) from motor unit, depending on motor torque.

c) Nominal Speed: 34 RPM. Not to vary due to load/lift capacity.

d) Isolated, low voltage power supply for powering external accessories connected to either the dry contact or network port.

1) Products requiring accessories to be powered by a plug-in or externally-supplied power supply are not acceptable.

2.3 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.

2. Shade Band and Shade Roller Attachment:

a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.

b. Provide for positive mechanical engagement with drive / brake mechanism.

c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" "snap-off" spline mounting, without having to remove shade roller from shade brackets.

d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.

e. Any method of attaching shade band to roller tube that requires the use of adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.4 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:

C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

2.5 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets

without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Motorized Shade Hardware and Shade Brackets:
1. Provide shade hardware constructed of minimum 1/8-inch (3 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade.
2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8 to 45 degrees from the motor axis between shade bands (4 to 22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).

C. Manual Operated Chain Drive Hardware and Brackets:
1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
7. Provide shade hardware constructed of minimum 1/8 inch (3 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
8. Drive Bracket / Brake Assembly:
    a. Mecho Drive Bracket model Mecho5x shall be fully integrated with all Mecho accessories, including, but not limited to: SnapLoc fascia, SnapLoc Zipper channels, room darkening side / sill channels, center supports and connectors for multi-banded shades.
    b. Mecho5x drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.5 mm) steel pin.
    c. The brake shall be an over-running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
    d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently

lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.

e. The entire Mecho5x assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.

f. Drive Chain: No. 10 qualified stainless steel chain rated to 90 lbs (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

2.6 SHADE MOTOR DRIVE SYSTEM

A. Shade Motors:
1. Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor, single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
2. Conceal motors inside shade roller tube.
3. Maximum current draw for each shade motor of 2.3 amps.
4. Use motors rated at the same nominal speed for all shades in the same room.

B. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade motor and tube assembly.

2.7 MOTOR CONTROLS, INTERFACES, AND ACCESSORIES

A. Unless indicated to be excluded, provide required equipment as necessary for a complete operating system providing the control intent specified. Provide components and connections necessary to interface with other systems as indicated.

A. Line-Voltage Wall Controls; IQ Switch:

B. Momentary dry contact switch enables manual local control of any individual shade motor.
1. Control Functions:
a. Open: Automatically open controlled shades to fully open position when button is pressed.
b. Close: Automatically close controlled shades to fully closed position when button is pressed.

2. Finish: White.
a. Provide engraved faceplate on switch indicating function, confirm with owner exact verbiage prior to ordering.

2.8 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

2.9 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

2.10 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (51 mm) to interior face of glass. Allow proper clearances for window operation hardware.

B. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:
   1. General Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
   2. General Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
   3. General Contractor shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
   4. General Contractor shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.
   5. General Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

E. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

2.11 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, blocking, locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Manufacturer Site Visit: 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 MOTOR CONTROLLER INSTALLATION

A. Comply with NECA 1 and NECA 130.

B. Comply with FCC guidelines.

C. Install window treatment motor operators and stationary control systems level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

D. Electrical Connections: Connect wired motor operators and stationary control systems to building electrical system in accordance with NEC requirements.

1. Grounding: Provide electrical grounding in accordance with NFPA 70.

3.3 ADJUSTING

A. Adjust motorized equipment to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

1. Program each motor-operator control system to Owner-provided program settings.

3.4 CLOSEOUT ACTIVITIES

A. Demonstration and Training: Engage a factory-authorized service representative to demonstrate and train Owner's maintenance personnel to adjust, operate, and maintain motor-operated units and networked automation motor control systems.

END OF SECTION 12 24 12

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   3. Storage and handling requirements and recommendations.
   4. Mounting details and installation methods.
   5. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
   1. Prepare shop drawings on Autocad or Microstation format using base sheets provided electronically by the Architect.

D. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

F. Warranty: Provide manufacturer’s warranty documents as specified in this Section.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642,

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.9 WARRANTY

A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.

C. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five year warranty.

D. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For motor operators and control systems to include in operation and maintenance manuals.

B. Warranty: For manufacturer's executed warranty documentation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Mecho, which is located at: 42-03 35th St.; Long Island City, NY 11101; Tel: 512-348-0962; Fax: 718-729-2941; Email: mason.biggi@mechoshade.com; Web:http://www.mechoshade.com , or a comparable product by another manufacturer.

2.2 ROLLER SHADE TYPE AND SHADECLOTH

A. Motorized Shades:
1. Motorized Shade System:
a. ElectroShade with WhisperShade IQ2 EDU (120V)
b. Shade Type: Single Roller.
a. Mounting: Wall Mounted with fascia
c. Drop Position: Regular roll.

d. Blackout Shadecloths:
1) Fabric: Chelsea: 0250 series. Opaque.
2) Color: Selected from manufacturer's standard colors.
e. Hembars: Maintains bottom of shade straight and flat.
1) Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
f. Accessories:
a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
1) Finish: Baked enamel.
2) Color: White.
3) Profile: Square.
g. System Capabilities:
1) Line Voltage EDU (120 VAC):
a) Basis of Design: MechoShade Systems LLC; WhisperShadeIQ2 System. Tubular, asynchronous, integral AC motor and reversible capacitor. 120 VAC, single phase, 60 Hz; temperature Class B,

thermally-protected, totally enclosed, maintenance-free. Powered by line voltage power supply connection equipped with locking disconnect plug assembly furnished with EDU.

b) Audible Noise: 46 dBA measured 3 ft (914 mm) from motor unit, depending on motor torque.

c) Nominal Speed: 34 RPM. Not to vary due to load/lift capacity.

d) Isolated, low voltage power supply for powering external accessories connected to either the dry contact or network port.

1) Products requiring accessories to be powered by a plug-in or externally-supplied power supply are not acceptable.

2.3 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.

2. Shade Band and Shade Roller Attachment:

a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.

b. Provide for positive mechanical engagement with drive / brake mechanism.

c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" "snap-off" spline mounting, without having to remove shade roller from shade brackets.

d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.

e. Any method of attaching shade band to roller tube that requires the use of adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.4 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:

C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

2.5 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets

without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Motorized Shade Hardware and Shade Brackets:
1. Provide shade hardware constructed of minimum 1/8-inch (3 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade.
2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8 to 45 degrees from the motor axis between shade bands (4 to 22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).

C. Manual Operated Chain Drive Hardware and Brackets:
1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
7. Provide shade hardware constructed of minimum 1/8 inch (3 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
8. Drive Bracket / Brake Assembly:
   a. Mecho Drive Bracket model Mecho5x shall be fully integrated with all Mecho accessories, including, but not limited to: SnapLoc fascia, SnapLoc Zipper channels, room darkening side / sill channels, center supports and connectors for multi-banded shades.
   b. Mecho5x drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.5 mm) steel pin.
   c. The brake shall be an over-running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
   d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently

lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.

e. The entire Mecho5x assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.

f. Drive Chain: No. 10 qualified stainless steel chain rated to 90 lbs (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

2.6 SHADE MOTOR DRIVE SYSTEM

A. Shade Motors:
1. Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor, single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
2. Conceal motors inside shade roller tube.
3. Maximum current draw for each shade motor of 2.3 amps.
4. Use motors rated at the same nominal speed for all shades in the same room.

B. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade motor and tube assembly.

2.7 MOTOR CONTROLS, INTERFACES, AND ACCESSORIES

A. Unless indicated to be excluded, provide required equipment as necessary for a complete operating system providing the control intent specified. Provide components and connections necessary to interface with other systems as indicated.

A. Line-Voltage Wall Controls; IQ Switch:

B. Momentary dry contact switch enables manual local control of any individual shade motor.
1. Control Functions:
a. Open: Automatically open controlled shades to fully open position when button is pressed.
b. Close: Automatically close controlled shades to fully closed position when button is pressed.

2. Finish: White.
a. Provide engraved faceplate on switch indicating function, confirm with owner exact verbiage prior to ordering.

2.8 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

2.9 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

2.10 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (51 mm) to interior face of glass. Allow proper clearances for window operation hardware.

B. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:
   1. General Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
   2. General Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
   3. General Contractor shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
   4. General Contractor shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.
   5. General Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

E. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

2.11 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, blocking, locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Manufacturer Site Visit: 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 MOTOR CONTROLLER INSTALLATION

A. Comply with NECA 1 and NECA 130.

B. Comply with FCC guidelines.

C. Install window treatment motor operators and stationary control systems level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

D. Electrical Connections: Connect wired motor operators and stationary control systems to building electrical system in accordance with NEC requirements.

1. Grounding: Provide electrical grounding in accordance with NFPA 70.

3.3 ADJUSTING

A. Adjust motorized equipment to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

1. Program each motor-operator control system to Owner-provided program settings.

3.4 CLOSEOUT ACTIVITIES

A. Demonstration and Training: Engage a factory-authorized service representative to demonstrate and train Owner's maintenance personnel to adjust, operate, and maintain motor-operated units and networked automation motor control systems.

END OF SECTION

SECTION 12 24 13 - ROLLER WINDOW SHADES

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. Manually operated roller shades with single rollers at the following Window Types:
   a. A2, A4, A6, B3, C15, C16, C17, C18 - See Drawings.

B. Related Requirements:
1. Section 08 80 00 - “Glazing” for installing roller shades in glazed units.
2. Section 08 88 53 - “Security Glazing” for installing roller shades in security glazed units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches long.

E. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

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. Hunter Douglas Contract.
2. Insolroll Window Shading.
3. MechoShade Systems, Inc.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless steel.

a. Loop Length: Full length of roller shade.

b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

B. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

C. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Color and Finish: As selected by Architect from manufacturer's full range.

D. Installation Accessories:

1. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.

a. Closure-Panel Width: 2 inches.

2. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller-shade manufacturer.
2. Type: Woven PVC-coated fiberglass and PVC-coated polyester.
3. Weave: Basketweave.
4. Roll Width: To accomodate full width of opening.
5. Openness Factor: 3 percent.
6. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 13 34 23 – FABRICATED SHADE STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
   1. Prefabricated metal shade structure & covered bicycle storage.

B. Related Sections:
   1. Division 3 Sections 03 10 00 - “Concrete Formwork”, 03 20 00 - “Concrete Reinforcement”, 03 30 00 – “Cast-In-Place Concrete”, & 03 34 50 – “Concrete Finishing”.
   2. Division 5 Section 05 50 00 - “Metal Fabrications”.
   3. Division 9 Section 09 91 13 - “Exterior Painting”.

1.3 DESIGN REQUIREMENTS

A. The building shall be designed by the Manufacturer as a complete system. All components of the system shall be supplied or specified by the same manufacturer.

B. Dead Loads:
   1. The dead load shall be the weight of the Metal Building System and as determined by the system manufacturer.

C. Collateral Loads:
   1. The collateral load shall be as shown on the contract drawings. Collateral Loads shall not be applied to the roof panels.

D. Live Loads:
   1. The building system shall be capable of supporting a minimum uniform live load of 20 psf., non-reducible.

E. Snow Loads:
   1. The design snow loads shall be as defined on the contract drawings.

F. Wind Loads:
   1. The design wind speed for the metal building system shall be as defined on the contract documents.

G. Seismic Loads:
   1. Seismic load shall be as defined on the contract documents.
   2.

H. Rainfall Intensity
1. All exterior gutters and downspouts shall be designed for rainfall intensity based upon a 5-year recurrence interval for a five-minute duration. All interior gutters, valleys and downspouts shall be designed for rainfall intensity based upon a 25-year recurrence interval based on a five-minute duration.

1.4 SUBMITTALS

A. Note: All manufacture drawings and design calculations shall bear the professional seal and signature of a licensed professional engineer registered in the state of Nevada.

B. Submit anchor bolt placement plan, column reactions, 60 days in advance of erection drawings.

C. Product Data: Provide data on profiles, component dimensions, fasteners, and color selections.

D. Manufacturer's Installation Instructions:Indicate preparation requirements, and assembly sequence.

E. Shop or Erection Drawings: Indicate assembly dimensions, locations of structural members, connections, attachments, openings, cambers, loads, and wall and roof system dimensions, general construction details, anchorages and method of anchorage, installation and framing anchor bolt settings, sizes, and locations from datum, foundation loads and indicate field welded connections with AWS A2.4 welding symbols; indicate net weld lengths.

1.5 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with MBMA Metal Building Systems Manual, and, for items not covered, AISC - Specification for Structural Steel Buildings

B. Manufacturer Experience: Provide products of this section by companies which have successfully specialized in production of this type of work for not less than 3 years.

1.6 QUALIFICATION

A. Manufacturer: The company manufacturing the products specified in this Section shall have a minimum of 10 years' experience in the manufacture of steel building systems. The metal building systems manufacturer shall be accredited under the International Accreditation Service, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems (AC472)."

B. Structural framing and covering shall be the design of a licensed Professional Engineer experienced in design of this work.

C. Erector shall have specialized experience in the erection of steel building systems for a period of at least 3 years.

1.7 FIELD MEASUREMENTS

A. Shade structure contractor shall verify that field measurements are as indicated on erection drawings.

1.8 WARRANTY

A. Shade structure manufacturer shall provide the following warranty:
1. Lifetime Limited Warranty on aluminum against material failure and corrosion.
2. 25-year Limited Warranty on steel against material failure and defects.
3. 10-year warranty against peeling, cracking, blistering, or crazing of the surface finish of aluminum components.
4. 1-year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

A. MATERIALS

B. The design is based on the following product: Navajo Shelter as manufactured by Americana Building Products, #2 Industrial Drive, Salem IL 62881. (888) 442.2928, www.americana.com

C.

1. Structural Steel:
   a. Steel Plate shall conform to the requirements of ASTM A36.
   b. Hollow structural sections (HSS) shall conform to requirements of ASTM A500, Grade
   c. Welding shall conform to the requirements of the American Welding Society's specification for the material being welded.
   d. Welding electrodes shall be E70XX.
   e. Structural steel components shall be coated with anti-graffiti polyester TGIC powder coat finish meeting AAMA 2604-02 specifications.

2. Aluminum Trim:
   a. Extruded aluminum ridge cap shall be fabricated from aluminum alloy 6105-T5.
   b. Extruded aluminum gutter fascia and fascia trim shall be fabricated from alloy 6061-T6 or 6105-T6.
   c. Aluminum components shall be coated with anti-graffiti polyester TGIC powder coat finish meeting AAMA 2604-02 specifications.

3. Roof Deck:
   a. Interlocking seal aluminum roof deck shall be roll formed from aluminum alloy 3004-H34.
   b. Roof deck shall be coated with heat reflective BASF Ultra-Cool coating or approved equal.

4. Fasteners:
   a. High strength bolts shall conform to ASTM A325 or A307.
   b. Screws attaching to steel shall be 12-24 hex washer head #5-point self-drilling screws.
   c. Screws attaching to aluminum shall be 8-18 hex washer head #2-point self-drilling screws.
   d. High strength bolts shall be hot dip galvanized. All screws shall be stainless steel or coated with zinc.

5. Colors: As selected by Architect from manufacturer's full range. Roof color shall be a different than columns and steel structure.
6. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that foundation, floor slab and placed anchors are in correct position and properly squared.

B. Provide access to the work as scheduled for owner provided inspections, if required. The cost of any required inspections is the responsibility of the owner.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Tolerances: Install products of this section to within the following tolerances:
1. Plus or minus 1/16 inch.

3.3 CLEANING

A. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces.
1. For cleaning, use only products and techniques acceptable to manufacturer of products being cleaned.

3.4 PROTECTION

A. General: Institute protective procedures and install protective materials as required to ensure that work of this section will be without damage or deterioration at substantial completion.

END OF SECTION 13 34 23

SECTION 14 24 00 - Hydraulic Elevators

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 hydraulic elevators.

B. Related Requirements:

1. Section 03 30 00 - "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Section 04 20 00 - "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
3. Section 05 10 00 - "Structural Steel Framing" for the following:

    a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
    b. Divider beams.
    c. Hoist beams.
    d. Structural-steel shapes for subsills.

4. Section 05 50 00 - "Metal Fabrications" for the following:

    a. Attachment plates and angle brackets for supporting guide-rail brackets.
    b. Divider beams.
    c. Hoist beams.
    d. Structural-steel shapes for subsills.
    e. Pit ladders.
    f. Cants in hoistways made from steel sheet.

5. Section 22 09 00 - "Plumbing Fixtures and Trim" for sump pumps, sumps, and sump covers in elevator pits.
6. Section 27 15 00 - "Communications Horizontal Cabling" for telephone service for elevators and for Internet connection to elevator controllers for remote monitoring of elevator performance.
7. Section 28 31 00 - "Fire Detection and Alarm" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.4 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
2. Include large-scale layout of car-control station and standby power operation control panel.
3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Initial Selection: For finishes involving color selection.

D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch-square Samples of sheet materials; and 4-inch lengths of running trim members.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and control closet layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 - "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: **5 years** from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements,

B. Basis-of-Design Product: Subject to compliance with requirements, provide Otis Elevator Company; 3500lb Otis Hydrofit Machine Roomless Elevator System – Rear Hoistway Access or comparable product.

C. Source Limitations: Obtain elevators, including hydraulic passenger elevators specified in another Section, from single manufacturer.

D. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

E. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

F. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator safety requirements for seismic risk Zone 2 or greater in ASME A17.1/CSA B44.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
2. Affected peak velocity acceleration (Av) for Project's location greater than or equal to 0.20 (seismic risk Zones 3 and 4).
3. Provide earthquake equipment required by ASME A17.1/CSA B44.
4. Provide seismic switch required by ASCE/SEI 7.
5. Project Seismic Design Category: D.
6. Elevator Component Importance Factor: 1.5.

2.2 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems, and as required for complete system.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Otis Elevator Company; 3500lb Otis Hydrofit Machine Roomless Elevator System – Rear Hoistway Access or comparable product.

C. Elevator Description:

1. Machine Location: Hoistway; no machine room is provided.
2. Machine Type: Hydraulic.
3. Rated Load: 3500 lb.
4. Rated Speed: 100 fpm.
5. Operation System: Simplex.
6. Auxiliary Operations:

    a. Emergency Return Unit.
    b. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44.

7. Security Features: Keyswitch operation.
8. Car Enclosures:

    a. Inside Width: 6'-6 3/4" from side wall to side wall.
    b. Inside Depth: 5'-6 1/8" from back wall to front wall (return panels).
    c. Inside Height: 7'-9" to underside of ceiling.
    d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
    e. Car Fixtures: Satin stainless steel, No. 4 finish.
    f. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
    g. Reveals: Satin stainless steel, No. 4 finish.
    h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
    i. Door Sills: Aluminum.
    j. Ceiling: Luminous ceiling.
    k. Handrails: Satin stainless steel, No. 4 finish, at back of car.

l. Floor prepared to receive resilient flooring as specified in Section 096813 "Entry Mat Carpet Tile".
m. Floor Thickness, Including Setting Materials: TBD.

9. Hoistway Entrances:

a. Width: 48 inches.
b. Height: 84 inches.
c. Type: Single-speed center opening.
d. Frames: Satin stainless steel, No. 4 finish.
e. Doors at Other Floors: Satin stainless steel, No. 4 finish.
f. Sills: Aluminum.

10. Hall Fixtures Satin stainless steel, No. 4 finish.
11. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.

2.3 SYSTEMS AND COMPONENTS

A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.

1. Pump shall be submersible type with submersible squirrel-cage induction motor and shall be suspended inside oil tank from vibration isolation mounts or shall be tank-top-mounted type with fan-cooled, squirrel-cage induction motor, and shall be mounted on oil tank with vibration isolation mounts and enclosed in prime-painted steel enclosure lined with 1-inch- thick, glass-fiber insulation board.

B. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.

C. Hydraulic Fluid: Nontoxic, biodegradable, fire-resistant fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives and approved by elevator manufacturer for use with elevator equipment.

1. Product: Subject to compliance with requirements, provide "Hydro Safe" by Hydro Safe Oil Division, Inc.

D. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

E. Car Frame and Platform: Welded or bolted steel units.

F. Guides: Roller guides; polymer-coated, nonlubricated sliding guides; or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car and counterweight frames.

2.4 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.

B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:

1. Single-Car Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to the next floor below, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control station and hall push-button stations. Key is removable in either position.

2.5 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound, and doors shall begin to close at reduced kinetic energy.

C. Object Detection: The door reopening device shall be capable of detecting approaching objects per ASME A17.1.2.13.5.3 and objects in the door path per ASME A17.1.2.13.5.4.

2.6 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with nonremovable wall panels, with removable car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor: Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness.
2. Subfloor: Exterior, C-C Plugged grade plywood, not less than 7/8-inch nominal thickness.
3. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
4. Fabricate car with recesses and cutouts for signal equipment.
5. Fabricate car door frame integrally with front wall of car.
6. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
7. Unfinished-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet, with factory-applied enamel.
8. Sight Guards: Provide sight guards on car doors.
9. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
10. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.

11. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.7 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: 1 hour with 30-minute temperature rise of 450 deg F.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Steel Subframes: Formed from cold- or hot-rolled steel sheet, with factory-applied enamel finish or rust-resistant primer. Fabricate to receive applied finish as indicated.
2. Stainless-Steel Frames: Formed from stainless-steel sheet.
3. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both inside surfaces of hoistway door frames.
4. Unfinished-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet, with factory-applied enamel.
5. Sight Guards: Provide sight guards on doors matching door edges.
6. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
7. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.8 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LEDs.

B. General: Provide signal equipment designed for destination-based system. Fabricate lighted elements with LEDs.

C. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.

1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

D. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

E. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 283100 " Fire Detection and Alarm"

F. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

G. Hall Push-Button Stations: Provide one hall push-button station at each landing.

1. Provide manufacturer's standard wall-mounted units.
2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
3. Equip units with buttons for calling elevator and for indicating direction of travel or destination as required by system. Provide a signaling system to verify floor selection, where destination registration is required, and to direct passengers to appropriate car.

    a. Provide a means for passengers to indicate that they have disabilities so control system can allow extra room in assigned car.
    b. Provide for connecting units that require destination registration to building security access system so a card reader can be used to register calls.

H. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Section 283111 "Digital, Addressable Fire-Alarm System."

I. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide **one of** the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
2. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
3. Units mounted in both car door jambs.

J. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

K. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrance at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.

1. Integrate ground-floor hall lanterns with hall position indicators.

L. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.

M. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

N. Emergency Communication System: Provide emergency communication system complying with IBC 3001.2-2018 and ASME A17.1-2019 regulations for the deaf, hard of hearing and speech impaired.

O. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.9 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

E. Bronze Plate and Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal).

F. Aluminum Extrusions: ASTM B 221, Alloy 6063.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and

doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.

G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

H. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Operating Test: Load elevator to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.

C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include **24** months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.
3. Include 24-hour-per-day, 7 day-per-week, emergency callback service with response time of 12 hours or less.

END OF SECTION 14 24 00

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VOLUME 2 Divisions 21 thru 33

Washoe County School District
Silver Dollar Elementary School

100% Construction Documents
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B. Requirements of Regulatory Agencies:
   1. NFPA Compliance: Install fire protection systems in accordance with the following standards: NFPA 13 (Standard for the Installation of Sprinkler Systems) and NFPA 24 (Private Fire Service Mains).
   2. UL Compliance: Provide fire protection products in accordance with UL standards; provide UL label on each product.
   3. All piping used in the project shall be both UL listed and FM approved.
   4. Fire Department/Fire Marshal Compliance: Install fire protection systems in accordance with the regulations of the local fire department and of the State Fire Marshal.

C. The automatic sprinkler system shall conform in every regard to the requirements of the International Building Code.

D. Installation of the sprinkler system shall not be started until complete plans and specifications (including water supply information and type of existing sprinkler system) have been reviewed by the authority having jurisdiction.

E. The fire suppression sprinkler system shall be installed by a licensed fire systems contractor, licensed by the State Fire Marshal's Office. Plans for such systems shall be submitted to the State Fire Marshal's office for review and approval prior to commencing installation.

1.5 SUBMITTALS

A. Reflected Ceiling Plans: Provide drawings showing location of all sprinkler heads throughout the building or project area and their relationship to all other materials forming part of the ceiling system. No fire sprinkler piping shall be shown on these drawings. Submit drawings to the Architect/Engineer prior to any other work. The Contractor shall make allowance in his bid for preparation and submittal of sprinkler location drawings in all areas. Prepare these drawings prior to the preparation of the engineered drawings required herein. Superimpose these drawings upon the reflected ceiling plans and show ceiling module, light fixtures, air inlets and outlets, and tile pattern where applicable.

B. Adjustments by the Architect/Engineer in these head locations are to be anticipated by the Contractor and shall be allowed for in bidding. No extra compensation will be allowed for spacing of sprinklers closer than the maximum area of coverage allowed by NFPA 13 where it is necessary to suit the ceiling module and lighting layout.

C. Drawings: Prepare and submit drawings to the Architect/Engineer for review. Drawings shall include product data for fire protection systems indicating pipe sizes, pipe locations, fittings, shutoffs, equipment, etc. Submit reviewed copies to the agency having jurisdiction, with the Engineer's stamp shown on each drawing before proceeding with the installation.

D. Calculations: Prepare hydraulic calculations for each fire protection system. Submit reviewed copies to the Architect/Engineer for review bearing the stamp and/or signature of the agency having jurisdiction, before proceeding with installation.

E. Product Data: Submit manufacturer's technical product data for fire protection materials and products as part of submittal to the Architect/Engineer.

F. Record Drawings: At project closeout, submit record drawings of the installed fire protection piping and products in accordance with all associated requirements.

G. Operation and Maintenance Data: Submit operation and maintenance data and parts lists for all fire protection materials and products. Include this data, product data, drawings, calculations, certificate of installation, and record drawings in the maintenance manual in accordance with all associated requirements.

H. Certificate of Installation: Submit certificate upon completion of fire protection piping work which indicates that work has been tested in accordance with NFPA 13 and that system is operational, complete, and has no defects.

PART 2 - MATERIALS

2.1 GENERAL

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure rating, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Contractor to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire protection systems. Where more than one type of materials or product is indicated, selection is the Contractor's option.

B. Equipment to be furnished under this specification shall be essentially standard product of manufacturer. Where two or more units of same class of equipment are required, these units shall be products of a single manufacturer. Component parts of the system need not be products of the same manufacturer.

2.2 BASIC IDENTIFICATION

A. Provide identification complying with Specification Section 230500 (Basic Materials and Methods for HVAC) in accordance with the following listing:
   1. Fire Protection Valves: Brass valve tags.
   2. Fire Protection Signs: Provide the following signs:
      a. At each sprinkler valve, including roof manifold, sign indicating what portion of system valve controls.
      b. At each outside alarm device, sign indicating what authority to call if device is activated.

2.3 BASIC PIPING AND PIPE FITTINGS

A. General: Provide piping and pipe fittings complying with Specification Section 230500 (Basic Materials and Methods for HVAC), Section 232100 (Hydronic Piping and Accessories), and in accordance with the following listing:

B. Pipe:
   1. Below ground piping shall be ductile iron, complying with Federal Specification WW-P-421D.
   2. At the Contractor's option, piping more than 2 feet from the building may be Polyvinyl Chloride (PVC) water pipe, Class 200, DR14, cast iron or ductile iron fittings, with Ring-Tite joints. Pipe shall be listed under AWWA C900.
   3. Above ground piping shall be Schedule 40 black steel pipe, in accordance with ASTM A135 and A53. At the Contractor's option, above ground piping may be Schedule 10 black steel, in accordance with ASTM A135.

C. Pipe Fittings:
   1. Below ground fittings shall be Ames series IBR in building riser, one piece 90 degree fitting fabricated of 304 stainless steel tubing. For use with cast iron pipe, American Water Works Association Standard Specification C100, Class D, 150 pounds; or listed as approved by Underwriters' Laboratories, Inc., list of Inspected Fire Protection Equipment and Materials or approved by any other appropriate, nationally recognized testing laboratory for use in sprinkler system.
   2. Above ground fittings shall be Federal Specification WW-P-501, Type I, Class A piping.

2.4 HANGERS AND SUPPORTS FOR FIRE SUPPRESSION SYSTEMS

A. See Specification Section 210530 (Hangers and Supports for Fire Suppression Systems).

2.5 SEISMIC BRACING FOR FIRE SUPPRESSION SYSTEMS

A. See Specification Section 210540 (Seismic Bracing for Fire Suppression Systems).

2.6 BASIC PIPING SPECIALTIES

A. Provide piping specialties complying with Section 220500 (Basic Materials and Methods for Plumbing) and in accordance with the following listing:

Pipe Escutcheons
Dielectric Unions
Pipe Sleeves
Sleeve Seals

2.7 FLEXIBLE CONNECTIONS

A. At the contractor's option, flexible braided hose connections may be utilized for connection to fire sprinkler heads. Flexible connections shall be installed in strict accordance with the product listing and with the manufacturer's installation instructions. Flexible connections shall be Tyco Fastflex Model FB, or approved equal.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering valves which may be incorporated in the work include the following:

Tyco Fastflex
Viking Flexhead
Victaulic VicFlex

2.8 BASIC SUPPORTS AND ANCHORS

A. Provide supports and anchors complying with Section 210530 (Hangers and Supports for Fire Suppression Systems) and in compliance with NFPA 13.

2.9 BASIC VALVES

A. Provide valves complying with Section 220500 (Basic Materials and Methods for Plumbing) and in accordance with the following listing:

1. Interior Valves
    a. Sectional: Gate valves or butterfly valves, UL listed.
    b. Check: Swing check valves, UL listed.

2.10 SPECIAL VALVES

A. Provide valves, UL listed, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

1. Alarm Check Valve: Provide cast iron water flow alarm check valve, 175 psi working pressure.
2. Hose Outlet Valves: Provide angle hose valves, 2-1/2 inch size where not otherwise indicated. Hose threads shall match the requirements of the local authority having jurisdiction. Provide bronze cap and chain at each valve location.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering valves which may be incorporated in the work include the following:

Tyco Fire Products
Potter Roemer
Guardian Fire Equipment
Stockham Valves and Fittings

2.11 BASIC METERS AND GAUGES

A. Provide meters and Specification Section 230500 (Basic Materials and Methods for HVAC). Pressure gauges shall be 0-250 psi range.

2.12 DOUBLE CHECK VALVE BACKFLOW PREVENTERS

A. Provide double check valve assembly consisting of two spring loaded brass check valves, two cast iron bronze fitted OS&Y gate valves and four test cocks, Febco Model LF856, or approved equal. Construct in accordance with AWWA Standard C510.
   1. Provide meter assembly and piping required to allow the unit to be used as a double detector check valve assembly.
   2. Backflow preventer shall be located inside the building. See drawings for location.

2.13 FIRE PROTECTION SPECIALTIES

A. Provide fire protection specialties, UL listed, in accordance with the following listing. Provide sizes and types which match piping and equipment connections.
   1. Install drains on main risers and auxiliary drains at all low points in the system.
   2. One inspector's test drain shall be installed for each sprinkler system.
   3. Drains and inspector's tests shall be at locations approved by the Architect.
   4. Provide drain line to floor sink or to outside, as required, to suit Project conditions.
   5. Five or fewer trapped heads will not require a drain valve but may be drained through a plugged fitting.
   6. Drain valves shall be of the angle type. Install in accordance with NFPA 13.
   7. Pipe drain valves to a floor sink or to the outside of the building. Discharge shall be visible from sight drain fitting or open-end drain pipe. Provide flushing connections at ends of all cross mains.

B. Flow Alarm: Furnish and install a flow alarm system for each main sprinkler riser as shown on the drawings. The systems shall be complete with an Anvil VSR-F, or equal, flow switch, a UL approved 10 inch bell and a marked switch box with lock and wiring. The Contractor shall be responsible for wiring between switch, bell, and junction box. Provide junction box under Division 26. Wiring shall meet the requirements of Division 26. All controls shall be identified by permanent metal tags or other approved means. Alarm switch shall be UL or FM approved and shall have adjustable retard mechanism and two sets of contacts. Wiring between electrical distribution panel and junction box will be provided under Division 26.

C. Supervisory Switch: Fit the control valves on the fire sprinkler risers with monitor switch, Potter Electric Model OSYSU-1, or approved equal, with single pole, double throw switch actuator installed to change switch position when the OS&Y valve is being closed.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire protection specialties which may be incorporated in the work include the following:

   Tyco Fire Products
   Potter Electric
   Potter Roemer
   Guardian Fire Equipment

2.14 AUTOMATIC SPRINKLERS

A. Provide automatic sprinklers in accordance with the following listing. Provide 3mm glass bulb type quick response sprinklers with a temperature rating of 155°F, unless otherwise indicated.

B. Type: Spray pattern type, automatic closed type heads of ordinary degree temperature rating, except that sprinklers to be installed in the vicinity of heating equipment shall be of temperature ratings required by NFPA for such locations.

C. Available Manufacturers: Subject to compliance with requirements, manufacturer offering automatic sprinklers which may be incorporated in the work include the following:

Tyco Sprinkler Company

D. Types of Sprinklers:

1. Exposed Locations: Provide upright type heads at all areas with no finished ceilings, equal to Tyco Sprinkler Series TY-FRB quick response, upright, 5.6 K-factor, with 1/2" orifice.
   a. Where heads are located less than 8 feet above finished floor, or where heads are located in a gymnasium area, provide wire guards to protect heads from damage.
2. Concealed Locations: Provide upright-type heads or pendent type heads equal to Tyco Sprinkler Series TY-FRB quick response, 5.6 K-factor, with 1/2" orifice.
3. Sidewall Locations: Where required and where approved by the Architect/Engineer provide Tyco Sprinkler Series TY-FRB quick response, horizontal sidewall, 5.6 K-factor, with 1/2" orifice.
4. Finished Ceilings: Provide at all ceilings with lay-in acoustical tile and at plaster or gypsum board type ceilings Tyco Sprinkler Series RF-II concealed pendent sprinkler, 5.6 K-factor, with 1/2" orifice, and white cover plate.
5. Sprinkler Cabinet and Wrench: Furnish steel, baked red enameled, sprinkler box with capacity to store sprinklers and wrench sized to sprinklers. Spare sprinklers and wrenches called for under 'Extra Stock'.

2.15 SIAMESE CONNECTIONS

A. Provide exterior wall mount type cast brass siamese connections and escutcheon plate assembly, with fire department inlets with hose connections as required by local fire authority. Provide 6 inch rough chrome plated inlet and body equipped with individual drop clapper valves, brass plugs and chains, and constructed with the following additional construction features:

1. Finish: Polished Chrome Plated, or as determined by Architect/Engineer.
2. Cast Lettering: 'AUTO SPKR'.
3. Escutcheon: As required to suit the number and size of inlets.
4. Provide a check valve in the piping between the Siamese connection and the fire protection system. Where indicated on the drawings, provide a wafer style check valve, above grade in the riser to the siamese connection. Provide a ball drip above grade, on the siamese side of the check valve.

B. Available Manufacturers: Subject to compliance with requirements manufacturers offering siamese connections which may be incorporated in the work include the following:

Potter Roemer
Fire End & Croker Corporation
Elkhart Brass Manufacturing

2.16 PIPE SLEEVES

A. Where pipes pass through a concrete floor slab 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 and the concrete has been poured, 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 concrete floors or walls install a Schedule 10 galvanized metal sleeve providing between a 1/2 inch and 1 inch 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 in accordance with the applicable UL fire rating system.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe sleeves which may be incorporated in the work include the following, or approved equal:

3M

PART 3 - EXECUTION

3.1 LOCATION OF EQUIPMENT AND VALVES

A. Provide fire department connection at main entry to building or where indicated on the drawings.

B. Provide zone valves and sprinkler systems at all floors and for the following areas:

3.2 INSPECTION

A. Examine areas and conditions under which fire sprinklers are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the Contractor.

3.3 INSTALLATION OF SPRINKLERS IN FINISHED CEILINGS

A. Where heads are located in grid or tile ceilings with regular pattern, heads shall be in center of tile or grid measured in both directions.

3.4 CLEARANCE

A. Clearance through walls and floors shall adhere to 2016 NFPA 13 Section 9.3.4 (Clearance).

3.5 EXTRA STOCK

A. Spare Heads: For each style and temperature range required, furnish additional sprinkler heads, amounting to one unit for every 100 installed units but not less than 10 heads, in proportion to the total number of each style of head.

B. Wrenches: Furnish two sprinkler wrenches for each type and size of sprinkler connection.

C. Obtain receipt from the Owner that the extra stock has been received.

3.6 FIELD QUALITY CONTROL

A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains, lead-in connections, and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system as required to remove foreign substances under pressure as specified in NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

B. Hydrostatic Testing: After flushing system, test fire sprinkler piping hydrostatically for period of 2 hours at not less than 200 psi or at 50 psi greater than system pressure where pressure is anticipated to be in excess of 150 psi. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested.

C. Repair or replace piping system as required to eliminate leakage in accordance with NFPA standards for ‘little or no leakage’ and re-test as specified to demonstrate compliance.

3.7 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

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 the Architect/Engineer. At completion, carefully clean and adjust equipment and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.9 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 21 05 30 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 210000 (Fire Suppression Systems) and Section 210540 (Seismic Bracing for Fire Suppression 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 21 05 30 (Hangers and Supports for Fire Suppression Systems)
Specification Section 21 05 40 (Seismic Bracing for Fire Suppression Systems)

B. Fire Sprinkler Piping: Hangers and supports for fire sprinkler piping shall be designed in accordance with the latest adopted edition of NFPA Standard 13 Chapter 17 (Hangers and Supports).

Steel Piping	Maximum Spacing	Reference
1-1/4” and smaller	12 feet	NFPA 13 Table 17.4.2.1
1-1/2”	15 feet	NFPA 13 Table 17.4.2.1
2” thru 8”	15 feet	NFPA 13 Table 17.4.2.1
Lightwall Steel Piping	**Maximum Spacing**	**Reference**
3” and smaller	12 feet	NFPA 13 Table 17.4.2.1

1.3 SUMMARY

A. 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 210540 (Seismic Bracing for Fire Suppression 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.

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. Delegated Design Submittal: 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 210540 (Seismic Bracing for Fire Suppression 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.

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 fire suppression 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 METAL 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.

2.3 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.

2.4 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:
      a. B-line
      b. Unistrut
      c. Flex-Strut
      d. G-Strut
      e. 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.

2.5 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:
   1. Pipe Shields
   2. nVent/Caddy
   3. Buckaroos
   4. Carpenter & Paterson
   5. Piping Technology & Products
   6. Rilco Manufacturing
   7. Value Engineered Products

B. Insulation Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100 psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psi minimum compressive strength and vapor barrier.

C. Insulation Insert Material for Hot Piping: Water repellent treated, ASTM C533, Type I calcium silicate with 100 psi ASTM C552, Type II cellular glass with 100 psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psi minimum 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 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 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 or 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:
      a. Hilti
      b. ITW Ramset/Red Head
      c. MKT Fastening
      d. 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:
      a. Hilti
      b. ITW Ramset/Red Head
      c. MKT Fastening
      d. B-line

2.7 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 Manufacturers:
   1. 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. Miro Industries
      b. PHP Systems/Design
      c. RectorSeal HVAC
      d. 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, but are not limited to, the following:
   a. Miro Industries
   b. PHP Systems/Design
   c. 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 stainless steel, continuous thread 1/2 inch rods.
5. Horizontal Member: Adjustable horizontal, galvanized or stainless steel pipe support channels.
6. Pipe Supports: Roller strut clamps, clevis hanger, or swivel hanger.
7. Hardware: Galvanized stainless steel.
8. Accessories: Protection pads.
9. Height: 12 inches above roof Insert lesser dimension above roof.

D. High 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, but are not limited to, the following:
   a. Miro Industries
   b. PHP Systems/Design
   c. Rooftop Support Systems
2. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
3. Base: Single vulcanized rubber or molded polypropylene.
4. Vertical Members: Two, galvanized stainless steel, continuous thread 1/2 inch rods.
5. Horizontal Member: One, adjustable height, galvanized stainless steel pipe support slotted channel or plate.
6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
7. Hardware: Galvanized stainless steel.
8. Accessories: Protection pads, 1/2 inch continuous thread galvanized steel rod, 1/2 inch continuous thread stainless steel rod.
9. Height: 36 inches above roof Insert lesser dimension above roof.

E. High Profile, Multiple Pipe Stand:
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. Miro Industries
   b. PHP Systems/Design
   c. RectorSeal HVAC
   d. 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 stainless steel channels.
5. Horizontal Members: One or more, adjustable height, galvanized stainless steel pipe supports.
6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
7. Hardware: Galvanized stainless steel.

8. Accessories: Protection pads**,** 1/2 inch continuous thread rod.
9. Height: 24 inches above the roof or as indicated on the drawings.

F. 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.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment support made from structural carbon steel shapes.

2.9 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.

2.10 HANGER AND SUPPORT MATERIALS

A. Comply with MSS SP-58 for pipe hanger selections and applications that are not specified in piping system sections.

B. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field applied finish.

C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

D. Use carbon steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

E. Use copper plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal hanger shield inserts for insulated piping and tubing.

H. 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 inches of 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 inches of 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 36” 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 30” size , from two rods if longitudinal movement caused by expansion and contraction might 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 might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2” thru 42” size if longitudinal movement caused by expansion and contraction might 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 might 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 might be required in addition to expansion and contraction.

I. 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.

J. 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 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450°F piping 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 to 450°F piping installations.

K. 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): 1500 lbs.
      c. Heavy (MSS Type 33): 3000 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.

L. 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.

M. 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.

N. Comply with MSS SP-58 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder actuated fasteners and mechanical expansion anchors instead of building attachments where required in concrete construction.

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 inches thick 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. Equipment Support Installation: Fabricate from welded structural steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. 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.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. 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.

M. 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 4 and 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 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 inches long and 0.048 inch thick.
   b. 4” pipe: 12 inches long and 0.06 inch thick.
   c. 4” and 5” pipe: 18 inches long and 0.06 inch thick.
   d. 8” thru 14” pipe: 24 inches long and 0.075 inch thick.
   e. 16” thru 24” pipe: 24 inches long and 0.105 inch thick.
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 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.

3.4 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing to prevent swaying for equipment supports.

3.5 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.

3.6 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.
   1. 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 21 05 40 - SEISMIC BRACING FOR FIRE SUPRESSION SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Section 210000 (Fire Suppression Systems) and Section 210530 (Hangers and Supports for Fire Suppression Systems) are hereby made a part of this section.

1.2 GENERAL

A. Seismic bracing for fire suppression 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

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. Design of connections for hangers, supports, and bracing shall comply with the requirements indicated on the structural drawings.

G. 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 210530 (Hangers and Supports for Fire Suppression 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, 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 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) are hereby made a part of this section.

B. This 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:

2018 International Building Code
2018 Uniform Mechanical Code
2018 Uniform Plumbing Code
2018 International Energy Conservation Code
2017 National Electrical Code
2018 International Fire Code
2018 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 these codes.

C. When the Contract Documents differ from governing codes, furnish and install the larger size or higher standards called for 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, pay all associated costs, 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 as follows:
      a. Provide complete submittal package including cover sheet with:
         1) Project Name
         2) Submittal Package Number (with Revision Number identified)
         3) Date
         4) Name and Address of Architect/Engineer
         5) Name of Contractor
         6) Name of Subcontractor

b. Group submitted items by specification section and provide:
   1) Index of submitted products with page numbers
   2) Name of Firm or entity that prepared submittal
   3) Name of Supplier
   4) Name of Manufacturer
   5) Equipment and/or fixture tag, if applicable
   6) Number and title of appropriate specification section

3. 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.
      1) Provide originally submitted sheet with Architect/Engineer comments.
      2) 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.

1.8 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 a manner suitable to the Architect/Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. 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.

B. Unless otherwise indicated, provide valves of same size as upstream pipe size.

C. No material installed as part of this work shall contain asbestos in any form.

2.2 MATERIALS AND EQUIPMENT

A. Mention herein or on drawings requires that this 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.

2.3 MATERIALS FURNISHED

A. Identify all materials and equipment by manufacturer's name and model number. Remove unidentified materials and equipment from site.

B. Equipment specified by manufacturer's number shall include all accessories, controls, etc. listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged. Replace with new equipment. Variance from this permitted only with written consent of the Architect/Engineer.

D. Provide an authorized representative to constantly supervise 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.

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 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 from 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 ACCESS

A. 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.

3.4 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.

3.5 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.

3.6 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 SEISMIC BRACING

A. See Specification Section 220540 (Seismic Bracing for Plumbing Piping and Equipment).

3.8 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.

3.9 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 made until all of the above have been completed and the balance report has been submitted and reviewed.

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 05 00 - BASIC MATERIALS AND METHODS FOR PLUMBING

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and Section 220000 (Plumbing) are 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. Materials
2. Valves
3. Valve Boxes
4. Hangers and Supports for Plumbing Systems
5. Seismic Bracing for Plumbing Systems
6. Flow Meters
7. Access Doors
8. Roof and Wall Flashings
9. Cathodic Protection
10. Thermometers
11. Pressure Gauges
12. Unions and Flanges
13. Pipe Escutcheons
14. Pipe Sleeves
15. Sleeve Seals
16. Low Pressure Strainers
17. Penetrations in Fire and Smoke Rated Partitions
18. Pipe Anchors and Guides
19. Piping and Equipment Identification
20. Detectable Underground Warning Tape
21. Concrete Work
22. Electric Heat Tracing
23. Electric Motors
24. Electric Motor Starters

B. Types of valves specified in this section include the following:

- Ball Valves
- Butterfly Valves
- OS&Y Valves
- Check Valves
- Gas Valves
- Manual Balance Valves
- Automatic Pressure-Compensating Balance Valves
- Motor Operated Ball Valves
- Pressure Relief Valves
- Emergency Fuel Shutoff Valves

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 manufacture of piping specialties and valves, 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 piping specialties and valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

D. Regulatory Agency Requirements: Valves used in fire protection piping shall be UL listed and FM approved.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of manufactured piping specialty and valve. Include pressure drop curve or chart for each type and size of valve, each control valve, and each balancing valve.

B. Operation and Maintenance Data: Submit operation and maintenance data and spare parts lists for each type of manufactured piping specialty and valve. Include this data and product data in operation and maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide factory-fabricated piping specialties and valves recommended by manufacturer for use in service indicated. All valves, fittings and accessories installed in potable water systems shall be rated for such use. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by the Contractor to comply with installation requirements. Provide sizes and connections which properly mate with piping, tubing, and equipment connections. Where more than one type is indicated, selection is the Contractor's option.

B. Unless otherwise indicated, provide valves of 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 VALVES

A. Provide valves as shown and other valves necessary to segregate branches or units. Furnish discs suitable for service intended. Furnish a brass tag with identification of service controlled for each valve. Properly pack and lubricate valves. Place a union adjacent to each threaded valve. Provide two unions at soldered valves. Provide flanged valves in welded pipe. Provide ball valves in water lines, unless otherwise shown.

B. Valves shall be full size of pipe, manufactured by Nibco, Apollo, Milwaukee, Nordstrom, or approved equal, in accordance with the following schedule and with the remainder of this specification section:

Ball Valves	3" and below	Nibco T-585-66-LF	Milwaukee UPBA-400S
Butterfly Valves	4" and above	Nibco LD-2022	Milwaukee ML-233E
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

C. Ball Valves: All ball valves shall have stainless steel ball and stem, PTFE packing, and throttling handle. Furnish the flow performance curve for each valve.

D. Butterfly Valves: All butterfly valves shall have EPDM seats with aluminum bronze disc, and throttling handle. Provide handles for shutoff service, and infinite position throttling capability with indicator plates for balancing.

E. Lockshield valves shall be lead-free ball type with locking lever, Nibco T-585-80-LF-LL, Crane D171LS, or approved equal.

F. 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, or approved equal. Variable orifice balancing valves are not acceptable.

G. 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.

H. Automatic Pressure-Compensating Flow Control Valves: Valves shall include removable stainless steel cartridge, union, and test ports. Valves shall be Pro-Hydronic Model AFLB (No Lead), IMI Flow Design Model ICSS (No Lead), Hays Mesurflo Model 2517 (No Lead), or approved equal.

I. Motor-Operated Ball Valves: Provide motor-operated ball valves where indicated on the drawings. Motor-operated ball valves shall be Belimo B2 Series, or approved equal.

J. Motor-Operated Butterfly Valves: Provide motor-operated butterfly valves where indicated on the drawings. Motor-operated ball valves shall be Belimo F6 Series, or approved equal.

K. 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.

L. 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.

M. 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 Section IV of the ASME Boiler and Pressure Vessel Code and ANSI Z21.22 where 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. Valves shall be Watts Series 174A, Series 374, Series 740, or approved equal.
3. Combined Pressure and Temperature 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 listing requirements for temperature and pressure discharge capacity. 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

N. Pressure Reducing Valves

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following, or approved equal:

   Watts Model 223-S-B
   Zurn Model 500XLYSBR

2. Pressure reducing valves shall comply with ASSE Standard 1003.
3. Pressure reducing valves shall be provided with the manufacturer's upstream strainer, and with an integral bypass capability. Provide upstream and downstream pressure gauges, and a full size valved bypass at each pressure reducing valve location.
4. Pressure reducing valve size shall be as indicated on the drawings, and/or as appropriate for the associated maximum water flow. Pressure reducing valves for closed hot water and chilled water system make-up shall be 1 inch unless indicated otherwise on the drawings. Provide parallel valves for water flows that are beyond the capacity of a 3 inch pressure reducing valve.
5. Valve Body shall be lead free brass or bronze. Valve end connections shall be threaded for valve sizes 2-1/2 inch and smaller, flanged for 3 inch valves.
6. Valves shall be rated for an initial pressure of 150 psi. Valves shall be selected for inlet and outlet pressures as indicated on the drawings.

O. General Purpose Solenoid Valves: Asco Series 8210, or approved equal.

P. Emergency Fuel Shutoff Valves: Asco Series S261 (gas), Asco Series SV401 (fuel oil), or approved equal.

2.3 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.

2.4 HANGERS AND SUPPORTS FOR PLUMBING SYSTEMS

A. See Specification Section 220530 (Hangers and Supports for Plumbing Systems).

2.5 SEISMIC BRACING FOR PLUMBING SYSTEMS

A. See Specification Section 220540 (Seismic Bracing for Plumbing Systems).

2.6 FLOW METERS

A. Flow Meters Make-Up Water: 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.

B. Flow Meters for Domestic Cold Water Mains: When shown on the drawings, provide Seametrics Model MJNE brass body flow meter, with hall-effect sensing, or approved equal. Flow meter shall be certified under NSF/ANSI Standard 61 for use in a potable water system.

2.7 ACCESS DOORS

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 entrance of a serviceperson may be required provide 18 inch by 24 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 the following:

Milcor Style K (Plaster)
Style A (AC Tile, Gypsum Board)
Style M (Masonry)
Style (Fire-Rated where required)

2.8 ROOF AND WALL FLASHINGS

A. Flashing for penetrations of the roof for plumbing items such as flues, ducts, and pipes will be furnished and installed under other sections of these specifications. The work of this section shall include layout, sizing, and coordination of penetrations required for the plumbing work.

1. Furnish and install counter-flashings above each flashing required in the plumbing work. Flues and ducts shall have A 24 gauge galvanized sheet metal storm collar securely clamped to the flue or duct above the flashing.
2. Sewer vents and other piping extending through roof structure shall have flashing provided and installed as part of the roofing work. This contractor shall coordinate his Work accordingly.

B. Sewer vents and other piping extending through roof structure shall have Semco, Smith, or equal to Semco #1100-4, with counterflashing sleeves installed.

2.9 CATHODIC PROTECTION

A. Furnish and install dielectric unions at all locations described herein, whether shown on the drawings or not, and except as noted herein. Construct couplings and flanges 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 plastic threaded in standard pipe sizes. Make up the flanges with insulating components consisting of a hard, phenolic gasket, bolt sleeves, and bolt washers. Supplement the insulating gasket with neoprene faces to form a seal.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following:

Maloney
Walter C. Vallet

2.10 THERMOMETERS

A. Thermometers shall be of the bimetal helix type, Miljoco Model B5099A, 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.	25° to 125°F
Hot water piping.	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 UNIONS AND FLANGES

A. Furnish and install unions at each threaded or soldered connection to all equipment, tanks and valves, of type specified in following schedule:

Type of Pipe	Union
Steel pipe 2" and smaller	150 lb screwed malleable ground joint, brass to iron seat, black for black piping, galvanized for galvanized piping.
Screwed steel, black or galvanized 2-1/2" and larger	125 lb cast iron screwed 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
Screwed black or galvanized steel pipe 2-1/2" and larger	125 lb cast iron screwed flange flat faced, black or galvanized as required, unless noted otherwise.
Welded steel pipe 2-1/2" and larger	150 lb forged steel welding flanges, 1/16" raised faced, unless noted otherwise.

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.

2.13 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:

Chicago Faucets
Pasco Specialty and Manufacturing
Sanitary-Dash

2.14 PIPE SLEEVES

A. Where pipes pass through a concrete floor slab 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 and the concrete has been poured, 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 concrete floors or walls install a Schedule 10 galvanized metal sleeve providing between a 1/2 inch and 1 inch 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 in accordance with the applicable UL fire rating system.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe sleeves which may be incorporated in the work include the following, or approved equal:

3M

2.15 SLEEVE SEALS

A. Provide sleeve seals for sleeves located in foundation walls below grade or in exterior walls as follows:

1. Pipe Sleeves through foundations & walls below grade: 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 water-tight seal.
2. Available Manufacturers: Subject to compliance with requirement, manufacturers offering mechanical sleeve seals which may be incorporated in the work include the following, or approved equal:

   Thunderline Link-Seal or Calpico

2.16 LOW PRESSURE STRAINERS

A. Provide wye or basket 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 drain fitting. 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 strainers 4" size and larger.

B. 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:

Metraflex
Taco
Bell & Gossett
Watts

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.
   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.

2.18 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 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 ASME 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:

Marking Services Incorporated (MSI)
LEM Products
Seton
Craftmark

2.20 DETECTABLE UNDERGROUND WARNING TAPE

A. Protect the following underground piping and conduit systems (when shown on the mechanical and/or plumbing drawings) with a detectable underground warning tape, as manufactured by Seton MSI, or approved equal.

1. All gas, fuel oil piping.
2. All heat pump loop piping, including ground loop piping.
3. Temperature control communication conduits.

B. Detectable underground warning tape shall consist of 5 mil foil tape printed with associated pipe service (e.g., 'Caution Gas Line Below').

C. Tape shall be buried approximately one half of the pipe buried depth.

1. Tape buried up to 24" deep shall be a minimum of 3" wide.
2. Tape buried greater than 24" deep shall be a minimum of 6" wide.

D. The methodology for locating the detectable underground warning tape shall be demonstrated by the Contractor utilizing an appropriate location device. Location device shall be Ridgid 'Seetech, Ridgid 'Navitrack', or approved equal.

2.21 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.

2.22 ELECTRIC HEAT TRACING

D. For projects that include electric heat tracing see Specification Section 222300 (Heat Tracing for Plumbing Piping).

2.23 ELECTRIC MOTORS

A. Electric motors larger than 1/2 horsepower (hp) rating shall be, 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 hp 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 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 hp 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

2.24 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 single phase control transformers.

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 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 mechanical 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.

3.2 EXCAVATION AND BACKFILL

A. Do excavating required for installation of piping and service lines and other work that applies as indicated on 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 trench and around pipe as required for caulking, joining, backfilling, and compacting.

C. Where invert elevations are not shown, dig trenches to sufficient depth to provide a minimum of 30 inches of fill above top of exterior piping, measured from adjoining finished grade, except as follows:

Outside water lines (36” inches minimum cover); Gas lines (30” 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 and 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 sand, fine earth, or other materials free of rocks and large lumps. 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 excavation placed in layers of 8 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 piping to prevent damage to the protective wrapping.

H. Bed sewers under pavements and any wrapped piping in sand prior to backfilling. Backfill to a point 6 inches above the pipe with sand.

I. When pipe or underground conduit with a protective wrapping is to be placed in the trench, sand only shall be used for bedding the pipe or conduit. The sand used shall be certified to have a minimum resistance of 5000 ohms per cubic centimeter when wetted to any moisture content with distilled water and shall consist of clean, natural, washed sand, hard, and durable particles varying from fine particles to particles of such size that all will pass through a 3/8 inch screen, not less than 90 percent will pass through a 1/4 inch screen, and not more than 25 percent will pass through a No. 50 screen.

J. Any backfill placed under this contract 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.

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 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.

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 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.

3.6 CONCRETE WORK

A. When required or shown on the drawings concrete work for plumbing shall be performed in accordance with Division 1. This Contractor shall coordinate all requirements accordingly.

3.7 INSTALLATION OF EXPANSION ANCHORS

A. Where permitted in other sections of this specification, expansion anchors may be used in hardened concrete.

B. Job Testing: Load test 50 percent of the expansion anchors on each job to twice 80 percent of the ICBO recommended allowable load in tension for that particular anchor, except that if the design load is less than 75 pounds, only one anchor in ten needs be tested. If any anchor fails, then all anchors shall be tested. Perform the load test in the presence of the Building Inspector.

C. Install drilled-in anchors in existing reinforced concrete, using care and caution to avoid cutting or damaging the existing reinforcing bars. Maintain a minimum clearance of one inch between the reinforcement and the drilled-in anchor.

3.8

3.9 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.

3.10 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. Where shown on the temperature control diagrams, the temperature control subcontractor shall furnish and install remote panel-mounted thermometers. Duct-mounted thermometers may be omitted at these locations.

C. Thermometers shall be placed at all locations shown on the drawings.

D. 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.

E. Thermometers provided as part of the temperature control work and located on a control panel need not be duplicated by the requirements listed above.

3.11 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 may be shown on the drawings.

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.

3.12 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.

3.13 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.

3.14 INSTALLATION OF STRAINERS

A. Install strainers full size of pipeline and in accordance with the manufacturer's installation instructions. Install pipe nipple and shutoff valve in the strainer blow-down connection, full size of the connection, except for strainers 2 inch and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide a drain line from the shutoff valve to the plumbing drain, full size of blow-down connection.

B. Locate strainers in 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:

3.15 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 union at each connection to equipment and downstream of each valve. Provide unions at both ends of valves when valves cannot be turned due to an obstruction.

D. 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 packing to stop leaks; replace valve if leakage persists.

E. Tag each valve and provide a complete listing of valve locations and functions. 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 valve.

3.16 INSTALLATION OF UNIONS AND FLANGES

A. Install unions and flanges so that piping can be easily disconnected for removal of tanks, equipment, and valves. Provide a minimum of two unions at each three-way valve.

3.17 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. The marking 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. Bore field circuit piping in the mechanical room shall be labeled to coincide with the GPS numbering of the bore field.

H. 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.

I. The sizes of the stenciled lettering and flow arrows shall be as follows:

Outside Diameter (Inches of Covering)	Size of Stencil Letter	Minimum Length of Flow Arrow
5/8" to 2"	1/2"	3"
2-1/2" to 4"	1"	4"
4"to 7"	2"	5"
Over 7"	3"	6"

J. Pipe Marking Schedule:

Legend	Color
Domestic Cold Water	Green
Domestic Hot Water Supply	Yellow
Domestic Hot Water Return	Yellow
Gas	Yellow
Sanitary Sewer	Brown
Storm Sewer	Brown
Plumbing Vent	Brown
Fire Sprinkler	Red

3.18 DEMOLITION WORK

A. Unless specifically indicated otherwise, demolition work shall include removal of all associated equipment, electrical/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.

3.19 ELECTRICAL WORK

A. Adequate working space shall be provided around electrical equipment in compliance with the National Electrical Code and other applicable codes or ordinances. The plumbing work shall be coordinated with the electrical work in order to comply with these requirements. Any work which does not conform to these regulations shall be properly corrected without additional cost to the Owner.

B. Furnish and install all line voltage and low voltage temperature control wiring in the plumbing work (typically performed by the temperature control subcontractor) including all interlock wiring between motor starters, interlock relays, and temperature control equipment. Unless noted otherwise, this does not include primary control wiring between starters and pushbuttons or other manual starter switch or branch power circuits required for temperature control systems.
   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. All such equipment shall be delivered to the electrical contractor for mounting and connecting to power wiring. Coordinate all motor starter requirements with the electrical contractor.
   3. Temperature control equipment, including relays shown on control diagrams, shall be furnished and installed by the temperature control subcontractor.
   4. Electrical devices with piping connections, such as control 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 plumbing contractor.

C. 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 factory before shipment.

D. All electrical work and equipment, including internal wiring, must comply with applicable codes and applicable portions of electrical specifications. Install all line and low voltage control wiring in conduit. Conduit for temperature control wiring shall be responsibility of the plumbing contractor and shall be of type specified in the electrical specifications.

3.20 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.

3.21 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.22 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) are hereby made a part of this section.

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 specification sections covering additional work, requirements, and materials specifically applicable to the work of each section. Requirements of subsequent sections of the specifications, if in conflict with these requirements, shall govern.

1.3 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. The Conditions of the Contract (General, Supplementary, and other Conditions), Section 220000 (Plumbing), 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	
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	
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. 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.

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.

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 METAL 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.

2.3 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.

2.4 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:
      a. B-line
      b. Unistrut
      c. Flex-Strut
      d. G-Strut
      e. 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.

2.5 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:
   1. Pipe Shields
   2. nVent/Caddy
   3. Buckaroos
   4. Carpenter & Paterson
   5. Piping Technology & Products
   6. Rilco Manufacturing
   7. Value Engineered Products

B. Insulation Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100 psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psi minimum compressive strength and vapor barrier.

C. Insulation Insert Material for Hot Piping: Water repellent treated, ASTM C533, Type I calcium silicate with 100 psi ASTM C552, Type II cellular glass with 100 psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psi minimum 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 inches beyond 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.

2.6 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 or 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:
      a. Hilti
      b. ITW Ramset/Red Head
      c. MKT Fastening
      d. 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:
      a. Hilti
      b. ITW Ramset/Red Head
      c. MKT Fastening
      d. B-line

2.7 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:
      a. Miro Industries
      b. PHP Systems/Design
      c. RectorSeal HVAC
      d. 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, but are not limited to, the following:
      a. Miro Industries
      b. PHP Systems/Design
      c. 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 stainless steel, continuous thread 1/2 inch rods.
   5. Horizontal Member: Adjustable horizontal, galvanized stainless steel pipe support channels.
   6. Pipe Supports: Roller strut clamps, clevis hanger, or swivel hanger.
   7. Hardware: Galvanized stainless steel.
   8. Accessories: Protection pads.
   9. Height: 12 inches above roof Insert lesser dimension above roof.

D. High 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, but are not limited to, the following:
      a. Miro Industries
      b. PHP Systems/Design
      c. Rooftop Support Systems
   2. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   3. Base: Single vulcanized rubber or molded polypropylene.
   4. Vertical Members: Two, galvanized stainless steel, continuous thread 1/2 inch rods.
   5. Horizontal Member: One, adjustable height, galvanized stainless steel pipe support slotted channel or plate.
   6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
   7. Hardware: Galvanized stainless steel.
   8. Accessories: Protection pads, 1/2 inch continuous thread galvanized steel rod, 1/2 inch continuous thread stainless steel rod.
   9. Height: 36 inches above roof Insert lesser dimension above roof.

E. High Profile, Multiple Pipe Stand:
   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. Miro Industries
      b. PHP Systems/Design
      c. RectorSeal HVAC
      d. 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 stainless steel channels.
   5. Horizontal Members: One or more, adjustable height, galvanized stainless steel pipe supports.

6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
7. Hardware: Galvanized stainless steel.
8. Accessories: Protection pads**,** 1/2 inch continuous thread rod.
9. Height: 24 inches above the roof or as indicated on the drawings.

F. 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.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment support made from structural carbon steel shapes.

2.9 OUTDOOR EQUIPMENT STANDS

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. MIRO Industries
2. RectorSeal HVAC
3. 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.

2.10 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.

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 inches thick 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. Equipment Support Installation: Fabricate from welded structural steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. 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.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. 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.

M. 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 4 and 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 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 inches long and 0.048 inch thick.
   b. 4” pipe: 12 inches long and 0.06 inch thick.
   c. 4” and 5” pipe: 18 inches long and 0.06 inch thick.
   d. 8” thru 14” pipe: 24 inches long and 0.075 inch thick.
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 SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing to prevent swaying for equipment supports.

3.4 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.

3.5 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.

3.6 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.
   1. 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.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are 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 inches of 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 inches of 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 36” 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 30” size , from two rods if longitudinal movement caused by expansion and contraction might 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 might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2” thru 42” size if longitudinal movement caused by expansion and contraction might 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 might 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 might 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 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450°F piping 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 to 450°F piping 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): 1500 lbs.
c. Heavy (MSS Type 33): 3000 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.

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), 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

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. Design of connections for hangers, supports, and bracing shall comply with the requirements indicated on the structural drawings.

G. 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.

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 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing) 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
Domestic Hot Water Supply and Return Piping
Non-Potable Cold Water Piping (Indoors)
Non Potable Cold Water Piping (Outdoors)
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, as tested by the ASTM E84 (NFPA 255) method.

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. General: All pipe insulation conductivities and thicknesses shall meet or exceed the requirements listed in International Energy Conservation Code Table C403.11.3.

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 of 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
      CertainTeed
      Owens Corning

F. Closed Cell Polyisocyanurate Insulation with Aluminum Jacketing:
   1. Closed cell polyisocyanurate insulation shall be Trymer 25-50, or approved equal. Install per manufacturer's recommendations. Insulation shall have a less than 25/50 flame spread and smoked developed rating in accordance with ASTM E84. Conductivity shall be .190 Btu-in/(hr-ft^2-°F) at 75°F. Insulation shall be rated for applications up to 300°F.
   2. Jacketing: Cover pipe and fitting insulation with .016" thick stucco-embossed aluminum jacketing with 'Polyfilm Moisture Barrier'. Install per manufacturer's recommendations.
   3. Finish all cold fittings as required to provide a vapor-tight seal.
   4. Secure all insulation jacketing with T-304 stainless steel bands at 12" on center.
   5. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

      Johns Manville ITW Insulation Systems

2.2 DOMESTIC COLD WATER (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:
      a. Piping 1-1/4 inch and smaller: 1 inch
      b. Piping 1-1/2 inch and larger: 1 inch

2.3 DOMESTIC HOT WATER (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 inch and larger: 1-1/2 inches

2.4 NON-POTABLE COLD WATER PIPING (INDOORS)

A. Insulate exposed non-potable cold water piping with fiberglass insulation covered with aluminum jacketing and aluminum fitting covers.

B. Insulate concealed non-potable cold water piping with fiberglass insulation.

1. Minimum Insulation Thickness:

a. Piping 1-1/4 inch and smaller: 1 inch

b. Piping 1-1/2 inch and larger: 1 inch

2.5 NON-POTABLE COLD WATER PIPING (OUTDOORS)

A. Insulate non-potable cold water piping installed outdoors with closed cell polyisocyanurate insulation covered with aluminum jacketing and aluminum fitting covers. Provide heat tracing where indicated on the drawings.

1. Minimum Insulation Thickness (All pipe sizes): 1 inch

2.6 RAINWATER PIPING (INDOORS)

A. Insulate rainwater piping with fiberglass insulation. Insulate fittings using Zeston Z-tape. Provide heat tracing where indicated on the drawings.

1. Minimum Insulation Thickness (All pipe sizes): 1 inch

B. Insulate roof drain sumps with a heavy coating of insulating mastic.

C. Overflow roof drain sumps and piping from overflow roof drains do not require insulation.

2.7 RAINWATER PIPING (OUTDOORS)

A. Insulate rainwater piping installed outdoors with closed cell polyisocyanurate insulation covered with aluminum jacketing and aluminum fitting covers. Provide heat tracing where indicated on the drawings.

1. Minimum Insulation Thickness (All pipe sizes): 1 inch

B. Insulate roof drain sumps with a heavy coating of insulating mastic.

C. Overflow roof drain sumps and piping from overflow roof drains do not require insulation.

2.8 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.

2.9 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:

   Johns Manville
   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:

   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.

D. Ice Machines: Insulate all ice machine drain piping which does not have factory-applied insulation with fiberglass Insulation. Insulation is not required on ice machine overflow drain piping. Minimum Insulation Thickness for all pipe sizes: 1 inch.

E. Manholes and Handholes: Manholes and handholes shall be made accessible by beveling the insulation around the manhole, and covering the manhole with a removable insulating fiberglass blanket, same thickness as the adjacent equipment insulation. Manhole and handhole covers shall be finished the same as the tank covering.

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) 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. Upon completion of plumbing systems, the test and balance agency shall complete tests, analysis, and balance of plumbing systems and equipment as appropriate.

B. 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 08 10 - PLUMBING SYSTEMS COMMISSIONING

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

A. Specification Section 01 91 13 (General Commissioning Requirements)

B. Specification Section 23 08 10 (HVAC Systems Commissioning)

C. Specification Section 26 08 10 (Electrical Systems Commissioning)

D. D. All other Specification Sections in Divisions 22, 23, and 26

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section

B. Owner's Project Requirements and Basis of Design documentation are included by reference for information only.

C. ASHRAE Guideline 0-2005, The Commissioning Process

1.3 DEFINITIONS

A. Basis of Design (BOD): The documentation of design criteria and assumptions for systems, components, and methods chosen to meet the Owner's Project Requirements and applicable regulatory requirements, standards, and guidelines. The document includes narrative descriptions of the systems to be commissioned. The BOD is prepared by the Design Professionals.

B. Building Automation System (BAS): The automated building system providing control and user interaction with select building systems, such as the HVAC, domestic hot water and lighting systems. Also, often referred to as building management system (BMS), energy management system (EMS), or an energy management and control system (EMCS).

C. Commissioning (Cx): A quality-focused process to verify and document that building systems are installed and perform as intended per the OPR, BOD and design documents.

D. Commissioning Authority (CxA): An independent entity hired directly by the Owner to lead, oversee and review the completion of the commissioning process and tasks. The CxA is not responsible for the design or construction of the project. The CxA is the authority on commissioning process, program elements and results, and assists the construction team with coordinating and completing tasks. And reviews and witnesses the completion of the process and tasks using a sampling approach.

E. Functional Performance Test (FPT): A test of the dynamic function, operation and control of the equipment and systems to verify system performance to the fullest extent. Systems are tested under various operating modes and control sequences including failure modes. The FPTs are performed using manual (direct observation) or monitoring methods. The FPTs can include

sequence of operation tests, verification tests, performance tests, integrated systems tests, and trend analysis (monitoring). FPTs are often referred to as acceptance testing.

F. General Contractor (GC): The contractor directly contracted to the Owner with overall responsibility for the project construction and all commissioning activities described herein.

G. HVAC: Heating, ventilation, air conditioning.

H. Installation Verification (IV): Field verification and documentation of proper installation of system equipment, assemblies, and components, per design documents, manufacturer guidelines and industry standards. The IV process is typically complete when systems are ready for startup or operation.

I. Owner's Project Requirements (OPR): A document describing the operational and functional requirements of a project, the expectations of how the facility will be used and operated, and the equipment and system expectations and requirements, as defined by the Owner. This document provides an explanation of the ideas, concepts, goals, success criteria, and supporting information for the project.

J. Pre-Functional Check/Test (PFCT): A check or test performed on a piece of equipment or system before, during, or after the initial startup and operation, but prior to the FPT phase. The PFCT is performed to confirm, verify and document the system equipment and individual components are working properly, are controlled properly and meeting applicable performance requirements and specifications. A PFCT example include verifying and documenting completion of the domestic pipe clean and disinfection.

K. Startup: Initial starting or activating of equipment usually performed by the Trade Contractor or the Manufacturer's authorized representative, including applicable PFCTs during the startup process.

L. Systems Manual: A manual that provides the operating staff the information needed to understand and optimally operate the commissioned systems. It expands upon the scope of traditional operating and maintenance documents and is compiled of multiple documents such as the final BOD, single line diagrams, and as-built controls drawings and sequences of operation.

M. TAB: Testing, Adjusting, and Balancing (TAB) work on the HVAC&R air and water systems to ensure design flow, pressure and temperature conditions are met. Performed by the TAB Trade Contractor.

N. Trade Contractor: A subcontractor who provides and installs specific building components and systems and/or provides certain services.

1.4 GENERAL COMMISSIONING DESCRIPTION

A. Commissioning is a quality-focused process for achieving, verifying and documenting that building systems are installed and perform functionally as intended according to the OPR, BOD, and the requirements of the design documents.

B. The work includes the completion and documentation of formal commissioning procedures by the GC, Trade Contractors, and the Manufacturer Representatives.

1. The GC and Trade Contractors shall provide the quality control for the installation, startup, checkout and testing of the systems. The commissioning process provides independent review and witnessing by the CxA (using a sampling approach) throughout the process and during qualitative functional performance testing, to observe and verify the implementation of the process, specific tasks and quality control efforts.
2. Refer to Section 019113, General Commissioning Requirements for summary description of the general commissioning process and requirements.
3. The Trade Contractors and the Manufacturer Representatives shall be responsible for participation in the commissioning process as outlined in this specification and Section 019113 General Commissioning Requirements.

C. Systems and equipment to be commissioned:

1. Domestic cold and hot water systems, including piping, water heaters, re-circulation pumps, thermostatic mixing valves and associated controls.
2. Domestic hot water systems including water heaters, re-circulation pumps, thermostatic mixing valves and associated controls.
3. Pumping systems and controls, including booster, and sump pumps.
4. Plumbing fixtures with automatic controls.
5. Water and natural gas meters.
6. Central Plant Emergency Gas Shutoff Valve.
7. Electronic mixing valves
8. Electric heat tracing.

D. Systems and equipment not included in the commissioning are listed below. Commissioning of these systems may fall under the responsibility of the Contractor and/or the Authority Having Jurisdiction (AHJ) as noted in the design specifications.

1. Process systems and equipment.
2. Fire protection, suppression, and sprinkler systems.
3. Waste and vent systems, and storm water systems.
4. Compressed air, vacuum air, and other industrial air systems.

1.5 COMMISSIONING TEAM

A. The Commissioning Team is comprised of the following:

1. Owner and Owner’s Representatives
2. Commissioning Authority (CxA).
3. Design Professionals
4. General Contractor (GC)
5. Trade Contractors responsible for systems covered in this section include:
    a. Plumbing Contractor

b. BAS Contractor

c. TAB Contractor (if appliable for TAB of plumbing systems).

6. Manufacturer Representatives supplying equipment, materials, components and controls for the systems to be commissioned.

1.6 COMMISSIONING PROCESS

A. Submittal Reviews by the CxA

1. The CxA will review pertinent Trade Contractor submittals for the appropriate systems in the commissioning scope, concurrently with the Design Team and will provide review comments to the Design Team.

2. The GC shall provide a submittal log to the CxA for referencing the requested submittals to be reviewed by the CxA (for which the GC shall issue to the CxA concurrently with the submission to the Design Team). Alternatively, the GC shall include the CxA on the distribution of all Trade Contractor submittals issued to the Design Team, for systems applicable to this specification.

3. The GC shall issue the requested submittals to the CxA for review at the same time they issue the submittals to the Design Team.

4. The CxA will also use the information from the submittals to develop commissioning forms and test procedures.

B. Cx Plan and Form/Procedure Development

1. The CxA prepares a Preliminary Cx Plan either during the project final design phase or early construction phase. The Cx Plan provides guidance in the execution of the commissioning process during construction.

2. Commissioning during construction begins with a kickoff meeting conducted by the CxA where the CxA reviews the commissioning process and responsibilities with the appropriate team members. The CxA presents the Preliminary Cx Plan and discusses the project specific requirements.

3. The GC and Trade Contractors shall submit to the CxA, for review and approval, their written procedures and "blank" forms for completing all of the required Cx pre-functional tasks including IV, Startup, and PFCT tasks prior to conducting any of these tasks. See Paragraph 1.9 for the submittal requirements for the contractor procedures and blank forms, including the content requirements for the procedures and blank forms. The project specific procedures and blank forms will be further described in the Cx Plan.

a. IV forms are to provide field verification and documentation of proper installation of system equipment, assemblies, and components, typically completed prior to formal Startup. Where appropriate and approved by the CxA, these forms may be combined with the Startup forms.

i. The IV forms are either supplied by the Trade Contractor and/or the Manufacturer and shall include all checklists and verification requirements from the Manufacturer's installation and operation manual (IOM).

ii. The Trade Contractors are to verify equipment installation per the Manufacturer's guidelines and requirements, and thus are to use and complete

any applicable equipment IV checklists contained in the Manufacturer's IOM, in addition to any IV forms used by the Trade Contractors to verify system, equipment and assembly installation per design and industry standards.

iii. The IV forms may also contain any applicable design drawings, plans, details, or single line diagrams that will be field verified and signed off / checked by the Trade Contractor.

b. The Startup procedures and forms are either supplied by the Manufacturer and/or installing Trade Contractor and shall be used to document the completion of the formal startup procedures and associated checks and verifications during the startup and initial operation. And shall include all required startup and checkout procedures from the Manufacturer's IOM.

i. Where applicable, these forms shall include checks of the equipment internal / factory provided controls including sensors and control devices.

ii. Where required per the design specifications, the startups shall be completed by the authorized Manufacturer's representative.

c. PFCT procedures and forms are Trade Contractor provided written procedures and forms used to document the completion and results for the various checks and tests performed before, during, or after startup.

i. Example PFCTs include applicable domestic water pipe pressure tests, pipe disinfect and flush checks, and any applicable domestic water system TAB.

4. The CxA reviews the procedures and blank forms for all IV, Startup and PFCT tasks, and will issue any comments, which may include additions or changes to be made by the Trade Contractor to the forms and procedures, and/or supplemental forms may be issued by the CxA, where appropriate, to improve the forms and commissioning process.

5. The CxA will develop FPT procedures and forms and provide the draft forms to the GC and Trade Contractors for review and comment.

C. Pre-Functional Activities and Tasks

1. Meetings will be conducted throughout construction with commissioning team members, as required, to plan, coordinate, and schedule commissioning activities, review documentation, and resolve Cx issues.

2. The Trade Contractors shall perform the IV, Startup and PFCT tasks for all systems and equipment (no sampling allowed), unless the contract or design documents allow for sampling of the pre-functional tests.

3. In general, the GC and Trade Contractors are to complete the IV prior to Startups, but where appropriate and approved by the CxA, the IV and Startup can be combined into one task.

4. The Trade Contractors shall document the completion of the IV, Startup and PFCT tasks on the IV, Startup, and PFCT forms.

5. The GC shall submit all completed IV, Startup, and PFCT forms to the CxA, for review prior to conducting the FPTs, in a manner or software program approved by the CxA.

6. The CxA will review the completed IV, Startup, and PFCT forms. The CxA will also conduct various field observations and reviews of the installation including reviews of the completed IV forms, and may witness a sample of the Startup and PFCT activities.

Some witnessing of the PFCT activities may be performed as back-checks conducted by the Trade Contractor with the CxA, after PFCT forms are complete.

7. The Trade Contractor shall resolve any IV, Startup and PFCT issues or results deemed unacceptable by the CxA.

8. The CxA may create System Readiness Checklists to track the status and completion of the IV, IV, Startup, and PFCT forms, including review by the CxA, prior to the FPTs.

D. Functional Performance Testing

1. FPTs are to test the dynamic function, performance and control of the equipment and systems under various modes of operation. These tests verify the correct implementation of the sequences of operation and the system performance meets the design criteria. The FPTs are performed using manual (direct observation) or monitoring methods. FPTs include the following types of tests, where applicable:

   a. Sequence of Operation Tests

      i. Sequence of operation tests are witnessed by the CxA for each unique sequence of operation but may not necessarily be repeated across identical systems, equipment or spaces, if the contractor has verified the same programmed sequence of operation code (as tested) has been programmed across multiple identical systems, equipment or spaces, based sample verification tests witnessed by the CxA.

      ii. Testing certain critical or important sequences with a higher sample rate across identical systems, equipment or spaces, beyond the individual sequence of operation tests may be required and will be determined by the CxA.

   b. Verification Tests.

      i. Verification tests are often less detailed tests than the sequence of operation tests and are typically witnessed by the CxA at a higher sample rate.

      ii. Examples of verification tests include: a) verifying the control settings and alarm points are configured per the sequence of operation tests (without having to repeat the actual sequence tests) and b) verifying plumbing fixture automatic controls.

   c. Performance Tests.

      i. Performance tests are to be performed after the sequence of operation and verifications tests, and are focused on testing and verifying performance.

      ii. Examples include: a) testing and measuring fixture hot water temperature and delivery time per design criteria, and b) testing the DHW heater water flow and temperature performance per design.

   d. Integrated Systems Tests.

      i. Integrated systems tests verify the operation and performance of multiple systems together operating in a coordinated, stable and efficient manner. Often the integrated systems tests are combined with the performance tests.

      ii. Integrated systems tests may also be conducted via analysis of BAS trend data (if applicable).

2. The CxA will develop FPT forms that contain:

a. Specific step-by-step procedures to execute the test in a clear, sequential and repeatable format, including any control system point value or setpoint overrides required to simulate a test condition or sequence mode.

b. The expected system response and acceptance criteria of proper performance with a Yes/No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.

c. A section for recording actual system response, notes and comments.

3. Execution of the FPTs:

a. Once the IV, Startup and PFCT forms are complete, the Trade Contractors shall execute the FPTs, with the FPTs witnessed by the CxA, unless otherwise by the CxA.

b. The GC and Trade Contractors are responsible for ensuring all systems are installed, operating and performing per the requirements of the contract and design documents, and are ready for the FPTs.

c. The Trade Contractors shall determine what level of pre-testing is appropriate in order to prepare for the CxA witnessed FPTs.

d. A percent sampling approach may be used for executing the FPTs of identical systems and equipment. The approximate system sampling rates for the manual (direct observation) FPTs are defined in Part 3 of this specification and/or in the Cx Plan.

e. The acceptance criteria for the FPT sampling shall be zero, meaning, any FPTs that do not pass shall require the Trade Contractor to resolve the issue for all applicable systems and equipment (even those specifically not in the original sample) and new sample rates selected for a re-test executed by the Trade Contractor and witnessed by the CxA. The CxA shall deem the FPTs acceptable after all FPTs, including re-tests, have passed and resolution of all issues completed.

f. The CxA will document the results of all FPTs on the associated FPT forms created by the CxA, unless indicated otherwise on the FPTs.

g. The Cx Plan will define any required seasonal or deferred testing.

E. Cx Issues and Recommendations

1. Throughout the process, the CxA records Cx issues, observations and recommendations on the Cx Issues Log and distributes the Cx Issues Log to the team.

2. The Cx Issues Log requires contributions and input from each of the Cx team members and as such everyone on the Cx Team has a responsibility to update the log via the agreed upon mechanism.

3. The software program and format for the Cx Issues Log will be provided by the CxA or another software program and format may be used as approved by the CxA.

4. The GC and Trade Contractors shall correct the Cx issues and recheck or retest the system(s) without delay at no additional cost to the Owner.

5. The CxA will verify the completion of the issues and recommendations via onsite reviews or witnessed retests, documentation or photographs provided by the GC and Trade Contractors, or based on information and communications provided by the GC and Trade Contractors.

F. Training Verification

1. The GC shall submit a comprehensive Training Plan with specific training agendas and materials provided by the Trade Contractors, for review by the Design Team, CxA and Owner, prior to conducting any training.
2. The Training Plan shall meet the specific requirements in the contract documents and specifications for each applicable system to be commissioned, and may include both operations and maintenance (O&M) staff training and building occupant training.
3. The GC shall coordinate with the Owner and/or Owner's Representatives, as needed, regarding any specific requirements for occupant training.
4. The CxA will verify completion of the training by receiving a copy of all training class sign-in sheets and any training materials / handouts, to be provided by the GC or Trade Contractors. The CxA may also sample witness some of the training sessions.
5. The Trade Contractors will ensure all O&M manuals have been submitted to the Owner per the contract documents. The CxA may request copies of the O&M manual submittals for verification purposes.

G. Cx Report and Documentation

1. The CxA will develop the Systems Manual with assistance from the GC and Trade Contractors.
2. The CxA will complete the Commissioning Report and all associated documentation for the Owner with assistance from the GC and Trade Contractors.

H. Post-Occupancy Warranty Phase Commissioning

1. The CxA will report any identified operational or performance issues (identified by the building O&M staff or warranty phase Cx activities) to the GC via a Warranty Phase Cx Log for resolution by the GC and Trade Contractors during or prior to the end of the warranty period.
2. The Trade Contractors shall execute any defined seasonal or deferred FPTs, witnessed by the CxA.
3. The CxA may conduct onsite visits to review system operation and performance with the Owner's O&M team and/or may review system trend data during the Warranty Phase and will report any identified issues and recommendations from the trend analysis.
4. No later than either 10 months after substation completion or two months prior to the expiration of the first 12-month warranty period of building occupancy, the CxA will return to the facility to interview facility O&M staff, walk the facility and review systems operation and trend data where applicable. Key representatives from the GC and Trade Contractors shall attend a site walk-through and meeting, as determined by the CxA.

1.7 COMMISSIONING RESPONSIBILITIES

A. General

1. The Commissioning Team and all others involved in the commissioning process shall follow the Commissioning Plan, attend the commissioning kickoff meeting, and attend additional commissioning meetings as necessary.

B. Commissioning Authority (CxA)

1. See Section 019113, General Commissioning Requirements.

C. Owner

1. See Section 019113, General Commissioning Requirements.

D. Design Team

1. See Section 019113, General Commissioning Requirements.

E. General Contractor

1. See Section 019113, General Commissioning Requirements.

F. All Trade Contractors

1. Submit project specific written procedures and blank forms for completing all IV, Startup, and PFCT tasks, including manufacturer's installation checks and startup procedures, as a commissioning submittal. See Paragraph 1.9. Electronic files are acceptable.
2. Provide any equipment and construction submittals and shop drawings, control drawings, points lists and detailed sequences of operation (including any local, stand-alone controls independent of the BAS controls), meter lists, system diagrams and riser diagrams, and any other submittals or documentation for systems to be commissioned, as requested by the CxA. The system sequence of operation shall fully describe their equipment components and functionality, including setpoints, failure modes and alarm functions. The detailed sequence of operation shall be provided regardless of the completeness and clarity of the sequences in the design documents. Electronic files are acceptable.
3. Provide a list of any test metering and sensors to be used for sensor and device calibration purposes. All test meter and sensors shall have been calibrated within a year and have calibration documentation.
4. Attend commissioning meetings as directed by the CxA and GC to facilitate the commissioning process.
5. Assign personnel with expertise and authority to act on behalf of the Trade Contractor and schedule them to participate in and perform assigned commissioning tasks.
6. Ensure that any required manufacturer factory tests are performed and provide the factory test data and results where required.
7. Demonstrate and document proper system installation, startup and performance.
    a. Perform IV, Startup and PFCT tasks for all systems and equipment (no sampling), unless the contract or design documents allow for sampling of these tasks.

b. Ensure that any required manufacturer's representative field tests, inspections, startup and checkout of selected equipment are performed per the contract documents. Provide completed manufacturer documentation and commissioning forms for these activities.

c. Complete all IV, Startup and PFCT documentation clearly and legibly.

8. Provide a schedule and access for the CxA to witness any equipment Startup and PFCT tasks. Notify the GC and CxA at least 10 days in advance of Startup and PFCT tasks.

9. Address applicable Cx issues promptly. All IV, Startup and PFCT issues must be resolved before the FPTs can proceed.

10. Assist the CxA in preparing the FPT procedures, clarifying the operation and control of commissioned equipment where the specifications, control drawings or equipment documentation are not sufficient for writing detailed testing procedures.

11. Review the FPT procedures to ensure feasibility, safety and equipment protection, and provide necessary written alarm limits, setpoint changes and overrides to be used during the tests.

12. Setup any control system software points, global commands, overrides of any sensor values or relays, and overrides of any setpoints or schedules, to simulate certain conditions and operating modes, in order to conduct the FPTs.

13. Configure all control settings, schedules, alarms, graphics and programming logic for all control systems and any local equipment or stand-alone controls per the project specific sequence of operations.

14. Prior to conducting the CxA witnessed FPTs, place the systems and controls into the operating modes and test and verify all sequences of operation. Check all control system safety cutouts, alarms, and interlocks with other systems during each mode of operation prior to the FPTs. Ensure all systems are operating and performing per the design requirements, and have been pre-tested per the FPTs, and are ready for the CxA witnessed FPTs.

    a. The Trade Contractors shall determine the appropriate level of pre-testing, to prepare for the CxA witnessed FPTs.

15. Perform the FPTs, with the FPTs witnessed by the CxA. Provide at least 10 days advance notice to the GC and CxA for scheduling the FPTs.

16. Setup any control or monitoring system trends and provide all requested trend data for the FPTs and post-occupancy warranty phase commissioning review to the CxA.

    a. As an Owner approved option, the Trade Contractors may provide the CxA remote access to the BAS and any other control system, with the Owner's permission, which will allow the CxA to easily and directly download the trend data files.

17. Prepare a training agenda for each training class for the equipment and systems to be commissioned.

18. Coordinate with the GC and Owner to schedule and plan training. Execute training of Owner's personnel per approved training agenda and schedule. Provide copies of training class sign-in sheets and materials / handouts.

19. Prepare O&M Manuals according to the Contract Documents.

20. Assist the CxA in developing the Systems Manual, including providing as-built drawings, controls sequences, setpoints, single-line diagrams, etc., necessary for the Systems Manual.

21. Participate in any applicable integrated whole building tests under emergency power. This test is initiated by disconnecting the utility power to the building, and it will involve multiple disciplines. All Trade Contractors shall participate in the FPTs as required for operation of the inter-related systems.

G. BAS Trade Contractor

1. See Section 230810 for the additional specific BAS Trade Contractor responsibilities and commissioning submittal requirements, applicable for any BAS controls and monitoring for plumbing systems.

H. TAB Trade Contractor

1. See Section 230800 for the additional specific TAB Trade Contractor responsibilities and commissioning submittal requirements, applicable for any TAB work for plumbing systems.

1.8 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

A. Trade Contractor Pre-Functional Procedures/Plans and Blank Forms.

1. The Trade Contractors shall submit to the CxA all applicable project specific written procedures/plans and blank forms for all required IV, Startup and PFCT tasks for the project, at least 4 weeks in advance of performing any of these tasks. Provided below are the potential procedures/plans and blank forms required for the applicable plumbing systems. The requirements for the project specific procedures and blank forms may also be further described in the Cx Plan.

a. Domestic Hot Water and Plumbing System IV Forms (Equipment, Piping & Local Controls) - including the following.

i. IV forms are to provide verification of the make/model, components, and accessories upon receipt of the equipment and to provide field verification and documentation of proper installation of system equipment, piping, assemblies, and components per design and manufacturer requirements, typically completed prior to formal Startup. Where appropriate and approved by the CxA, these forms may be combined with the Startup forms.

ii. The IV forms are either supplied by the Trade Contractor and/or the Manufacturer, and shall include all checklists and verification requirements from the manufacturer's installation and operation manual (IOM). The Trade Contractors are to verify equipment installation and access per the manufacturer's guidelines and requirements, and thus are to use and complete any applicable equipment IV checklists contained in the IOM, in addition to any IV forms used by the Trade Contractors to verify system, equipment, piping and assembly installation per design and industry standards.

iii. The IV forms shall also include any applicable design drawings, plans, details, or single line diagrams that will be field verified and signed off / checked, particularly for verification of the system piping.

iv. The IV forms shall also include any local plumbing equipment factory controls or local stand-alone plumbing and DHW controls that are not installed by the BAS Contractor.

b. Domestic Hot Water and Plumbing System Startup Procedures and Forms - including the following.

i. The startup procedures and forms are to be supplied by the installing contractor and/or the manufacturer and shall include all required startup and checkout procedures from the manufacturer's IOM.

ii. Where required per the design specifications, the startups shall be completed by the authorized manufacturer's representative. In the submittal for the startup procedures and blank forms, the contractor shall indicate which startups will be completed by the authorized manufacturer's representative.

iii. The startup procedures and forms shall also include the checkout and verification of any local plumbing and DHW equipment factory controls or local stand-alone plumbing controls that are not installed by the BAS Contractor, including any setpoint configuration and programming checks per the project design sequence of operation.

c. Domestic Water Pipe System Pressure / Leak Test Procedures and Forms – including the following.

i. The sections of pipe to be tested and the associated test methods, pressures and durations,

ii. The applicable forms to be used to document the completion of the pressure / leak tests.

d. Domestic Water Pipe Clean / Disinfect & Flush Procedures and Blank Forms – including the following.

i. The intended minimum durations for all pipe cleaning, disinfections, and flushing.

ii. The associated cleaning agents and/or disinfectants to be used.

e. Water & Gas Meter IV and Pre-Functional Check Procedures and Forms – including the following.

i. The IV forms to be used to verify the meter installation and the meter programming / configuration / setup per the Manufacturer IOM and design requirements, including the communication modules for BAS integration.

ii. An outline of the pre-functional checks/tests to verify the meter flow readings of the installed meters.

iii. The applicable forms to be used for the above meter IV and pre-functional checks.

f. Plumbing Fixture Automatic Controls IV and Pre-Functional Check Forms – including the following.

i. Forms that are either floor plan-based checklists or room by room table checklists that indicate completion of the IV and pre-functional checks for each plumbing fixture with automatic controls.

ii. The intent of the forms is to verify the installation of each fixture controls per design documents and manufacturer requirements, to verify any applicable automatic control settings have been adjusted and checked, and to verify the operation and control has been tested.

g. Procedures/Plans for all other applicable plumbing systems IV and PFCT tasks, per the project design and specifications or as requested by the CxA.

2. For the requirements for the BAS Controls PFCT procedures and blank forms applicable to the plumbing systems, see Section 230810.

3. The CxA will review these submitted commissioning procedures/plans and forms including whether all project specific requirements are included.

4. The CxA may request additional data, changes and/or additions to these forms prior to their use, including forms any supplemental forms provided by CxA, based on the construction documents and specifications, manufacturer installation manuals and procedures, and/or industry standards or guidelines.

B. Training Agenda. The Trade Contractors shall develop a Training Agenda for each training session, per the requirements of the contract documents and specifications, and the LEED Enhanced Commissioning requirements, and may include both operations and maintenance (O&M) staff training and occupant training. The Training Agenda shall be included in the comprehensive Training Plan to be submitted by the GC for review by the CxA, Design Professionals, and/or the Owner (see Section 019113). The GC and Trade Contractors shall coordinate to fully develop the comprehensive Training Plan with input from the Owner.

1. The Training Agenda for each training session shall include the following:

a. equipment and/or systems covered;

b. recommended attendees;

c. proposed location;

d. estimated duration;

e. level of instruction to be provided and an outline of the training topics and subjects to be covered;

f. list of any materials and handouts to be provided (or provided in advance);

g. company to provide the training and the instructor’s name and qualifications.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 MEETINGS, SCHEDULING AND COORDINATION

A. See Section 019113.

3.2 DOCUMENTATION

A. The Trade Contractors have specific responsibilities for assisting in the development of equipment check, test and verification procedures and forms, and in performing and documenting commissioning tests, as directed by the GC and as overseen by the CxA.

B. The Trade Contractors shall provide, wherever the Contract Documents require, system checks and testing, test reports, factory test data and reports, checklists, operational verifications and demonstration, etc., whether specified or not in the commissioning sections.

3.3 TEST EQUIPMENT

A. The Trade Contractors shall provide all test equipment in sufficient quantities to execute all Startup, PFCT and FPT tasks in an expedient fashion.

B. The test equipment shall be of industrial quality and suitable for testing and calibration with accuracy within the tolerance necessary to demonstrate system performance per the Contract Documents. If not otherwise specified, the following minimum requirements apply:

C. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 degree F and a resolution to + or – 0.1 degree F.

D. Pressure sensors shall have an accuracy of + or – 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year.

E. The test equipment shall have calibration certification per equipment manufacturer's interval level or within one year if not otherwise specified. The calibration tags shall be affixed or certificates readily available for all test equipment.

3.4 COMMISSIONING PRE-FUNCTIONAL TASKS

A. The Trade Contractors shall conduct all IV, startup procedures and pre-functional checks/tests (PFCTs) without compromise to human or equipment safety. The GC and Trade Contractors shall be responsible for the liability and safety of conducting all startup, checks and tests.

B. The Trade Contractors shall clearly identify and list any issues and deficiencies resulting from the IV, Startup and PFCT tasks on the associated forms and immediately notify the CxA. The CxA will additionally document the issues on the Cx Issues Log. Once issues and deficiencies are corrected and verified, the associated forms shall be updated and resubmitted, and any necessary field review, back-checks or re-tests witnessed by the CxA.

C. The GC and Trade Contractors shall provide a minimum 10 days' notice to the CxA for witnessing equipment Startup and PFCT tasks.

D. The sample rates for the CxA witnessing of plumbing system PFCT tasks and equipment startups, will be defined in the Cx Plan.

E. The GC and Trade Contractors shall ensure the completion of the IV, Startup and PFCT forms. Review and approval of the completed IV, Startup and PFCT forms by the CxA is required prior to conducting the FPTs. The CxA may create System Readiness Checklists to track the status of the IV, IV, Startup, and PFCT forms, including review by the CxA, prior to the FPTs.

3.5 FUNCTIONAL PERFORMANCE TESTS

A. The Trade Contractors shall perform all FPTs per the final FPT forms, for all systems and equipment in the scope of commissioning. The FPTs shall be witnessed by the CxA unless stated

otherwise by the CxA. The Trade Contractors may need to complete off hours or weekend work in order to complete the FPTs. The CxA will document all testing results on the FPT forms.

B. As noted in the Part 1, a sampling approach will be used for the FPTs of identical systems and equipment, using the approximate sample rates as defined, with the specific systems and equipment selected by the CxA.

1. FPT Sample Rates for Domestic Hot Water Systems (including water heaters, storage tanks, pumps, recirculation pumps and controls, etc.):
    a. Sequence of Operation, Verification Tests and Performance Tests for *** all of the *** approximately 25% to 50% *** of the DHW systems by type, or at least one for each type, as selected by CxA.
2. FPT Sample Rates for Under Sink Instant-hot Electric Water Heaters
    a. Performance Tests for approximately 10% to 30% of the instant-hot water heaters, as selected by CxA.
3. FPT Sample Rates for Pumping Systems: DCW booster pumps, circulation pumps, sump pumps, sewage ejectors, etc.
    a. Sequence of Operation Tests for each unique pump type / sequence of operation.
    b. Verification Tests for approximately 25% to 50% of the pumps by type, or at least one of each type, as selected by CxA.
    c. The sample is 100% for any critical pumping systems, to be defined in the Cx Plan.
4. FPT Sample Rates for Plumbing Fixture Automatic Controls:
    a. Verification Tests for approximately 10% to 30% of the fixture automatic controls by type, or at least one of each type, as selected by CxA.
5. FPT Sample Rates for Water Recovery and Re-use Systems: all systems (no sampling).

C. The Trade Contractors shall determine what level of pre-testing is appropriate in order to prepare for the CxA witnessed FPTs.

D. The GC and Trade Contractors shall coordinate all FPTs with the CxA, and provide a minimum of 10 days' notice prior to conducting each test.

E. The GC and Trade Contractors shall have responsibility for the liability and safety of conducting all functional performance tests.

F. The Trade Contractor executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. to execute the test according to the test procedures.

1. The Trade Contractors shall provide any necessary control system global or system level commands and setpoint adjustments necessary to conduct the testing as called out in the FPT procedures. For example, globally adjusting the space temperature setpoints for all terminal units on a floor or AHU or the building. Or as another example, globally overriding the economizer status command for all AHUs.

G. At completion of the test, the Trade Contractor shall return all affected building equipment and systems to their pre-test normal condition.

3.6 TREND ANALYSIS

A. The CxA may conduct trend analysis as part of the FPT process, after completion of the onsite field conducted FPTs and correction of all issues and deficiencies, to verify integrated system operation and performance.

B. The CxA will prepare a BAS trend points list including the trend interval. The BAS Trade Contractor shall set up the trend log definitions prior to the start of the sequence of operation FPTs.

C. The BAS Trade Contractor shall provide the trend to the CxA in an electronic format, either a text file, CSV file or Excel file, with related system parameters grouped together. The estimated duration for the trend data is 1 to 3 weeks (with a minimum of 1 weeks' worth of data).

D. If the CxA discovers any control or performance issues during trend analysis, the Trade Contractors shall correct the issues and provide new trend data for analysis verification by the CxA.

3.7 COMMISSIONING ISSUES, BACK-CHECKS AND RE-TESTS

A. When Cx issues are identified during testing, the CxA will discuss with the executing Trade Contractor and/or GC and determine whether or not testing can proceed. The CxA may allow immediate correction of minor issues and deficiencies identified during testing. The Cx issue and any identified resolution will be documented on the test form in use in addition to the Cx Issues Log.

B. The CxA will maintain and update the Cx Issues Log, and document the issue resolution process. Copies will be distributed to the GC, Owner, and Trade Contractors as appropriate. The Trade Contractors shall provide updates and comments regarding issue status and resolution.

C. The Trade Contractors shall promptly correct all Cx issues. The responsible party shall correct the issue and inform the GC and CxA of the resolution and completion date, and update the Cx Issues Log accordingly (in the fields assigned for contractor updates).

D. The CxA will record completion on the Cx Issues Log after a successful witnessed re-test, field review, back-check, verification obtained through appropriate documentation or photographs, or acceptance by the Design Team or Owner. The GC shall reschedule any applicable re-testing with the CxA and Trade Contractor. The Trade Contractor shall retest until achievement of passing performance or Owner acceptance of the noted issue.

E. Where sampling is used for the PFCTs and FPTs, the results shall be deemed acceptable once all noted issues are resolved and any new sample tests or checks have passed.

F. Additional parties may require input during a dispute regarding a Cx issue. Regardless of the validity or responsibility of the issue, the CxA will have the final interpretive authority on Cx issues and the Owner will have the final approval authority.

G. The CxA may recommend solutions to Cx issues. However, the GC and Trade Contractors ultimately have the burden of responsibility to solve, correct and perform required retests.

H. Back-checks, Verifications and Re-testing:

1. The CxA will witness one (1) re-test or will perform one (1) field back-check or verification of any Cx issue.
2. The CxA's total onsite time for re-test witnessing and field verification or back-check of Cx issues will be limited to no more than 1 day for all applicable mechanical, electrical, and plumbing systems in the commissioning scope.
3. The Owner may back-charge the GC for any additional fees from the CxA, resulting from any additional re-testing or field back-checks or verification beyond this allocated total time.
4. The GC must provide a minimum 48 hours' notice for scheduling any re-testing, though the CxA will attempt to accommodate a shorter timeframe if feasible.
5. Any required re-testing shall not be considered a justified reason for a claim of delay or for a time extension.
6. For any re-testing required, the CxA will determine if the entire test must be re-tested or if it is acceptable to re-test specific portions of the test that had failed.

3.8 DEFERRED & SEASONAL TESTING

A. Before or during the end of the first year warranty period, the Trade Contractor shall complete any seasonal or deferred testing, required per the design specifications and as defined in the Cx Plan. The Trade Contractors shall complete tests in the same manner as all other commissioning tests, including CxA witnessing.

B. The GC and Trade Contractor shall coordinate with CxA and Owner and schedule all deferred and seasonal testing.

3.9 TRAINING VERIFICATION

A. The GC and Trade Contractors shall coordinate and schedule the training for the Owner's facility and operations personnel, and building occupants. The GC shall ensure that training is completed per the requirements of the contract documents and specifications.

B. Trade Contractors responsible for specific equipment and system training shall submit to the GC, a written training agenda for each training class for the equipment and systems to be commissioned. The GC shall submit a comprehensive Training Plan, including the specific training agendas, to Owner, Design Team and CxA for review and approval. See also Section 019113.

C. The CxA will review the Training Plans for commissioning verification prior to conducting the actual training.

D. For verification of actual training conducted, the GC shall submit to CxA 'attendee signed' attendance sheets for each training session conducted and a copy of any final training presentations or handout materials.

3.10 COMMISSIONING ACCEPTANCE, CLOSE-OUT AND REPORTING

A. Completion of the main commissioning activities (system readiness checks, functional performance testing, and training) shall be accomplished as a prerequisite for substantial completion. Completion of any re-testing shall be completed prior to final acceptance of commissioning.

B. After completion of the main commissioning activities and following review of the completed commissioning documents, test results and the current Cx Issues Log with the Owner, the Owner will indicate whether they accept completion of the project construction phase commissioning or if not, the requirements for acceptance. Upon Owner acceptance, any remaining open Cx issues will be transferred to the warranty phase Cx Issues Log for tracking resolution and completion as part of the warranty phase commissioning.

C. Upon completion of all commissioning activities, the CxA will prepare and submit to the Owner a Cx Report detailing all completed commissioning activities and documentation. The GC shall support this effort by providing all Trade Contractor commissioning documentation.

D. The CxA will complete a Systems Manual for the systems and equipment commissioned, following the LEED requirements, with assistance provided by the GC and Trade Contractors. The Systems Manual will provide the operating staff the information needed to understand and optimally operate the commissioned systems. It will also include the current facility requirements, and an ongoing commissioning plan.

3.11 POST-OCCUPANCY WARRANTY PHASE COMMISSIONING

A. The Trade Contractors shall execute any defined seasonal or deferred FPTs, witnessed by the CxA, to be witnessed by the CxA, unless stated otherwise by the CxA.

B. The CxA may conduct onsite reviews of the system operation and performance, meet with the O&M Team to discuss system operation and performance, and may also review BAS trend data during the Warranty Phase. The BAS Trade Contractor shall be responsible for providing post-occupancy trend data to the CxA.

C. The CxA will report any identified issues and recommendations to the GC via a Warranty Phase Cx Issues Log for review and resolution by the GC and Trade Contractors prior to the end of the warranty period, for any issues or recommendations identified either by the CxA or the Owner. The GC shall work with the Trade Contractors and O&M staff to make corrections and adjustments as required to address the issues and recommendations.

D. Key representatives from the GC and Trade Contractors shall attend a near end of warranty commissioning review meeting, to be scheduled with the Owner's facility staff and the CxA, no later than either 10 months after substation completion or two months prior to the expiration of the first 12-month warranty period of building occupancy.

1. During this meeting, the operation and performance of the systems will be discussed with the Owner's staff, the results of any commissioning reviews and trend analysis will be discussed and the Warranty Phase Cx Issues Log will be reviewed. If needed, a walk-through of the systems with the Owner's staff will be conducted.

2. Next steps and actions items for any open Cx issues and recommendations will be discussed and documented via meeting minutes or a field report issued by the CxA. The intent is to resolve any open Cx issues prior to the end of the warranty phase.

E. After correcting noted Warranty Phase Cx issues, the GC shall notify the CxA, and the CxA will back-check and verify resolution of the issues and recommendations.

F. Issues identified during the warranty period will remain warranty phase Cx issues until satisfactory completion by Trade Contractors, even if the warranty period expires during the correction and back-check period.

END OF SECTION 220810

SECTION 22 08 20 - THIRD PARTY COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing) are hereby made a part of this section.

1.2 THIRD PARTY COMMISSIONING AGENT CONTRACT AND PAYMENT

A. The third party commissioning agency will be contracted with and paid by the Owner.

1.3 DESCRIPTION

A. The work of this specification section includes furnishing labor and material to accomplish commissioning of the plumbing systems, including attendance at all third party commissioning meetings.

B. Plumbing systems commissioning work includes but is not limited to:

1. Verifying correct operation and functional performance of plumbing systems for compliance with the ‘Design Intent’ as indicated on the drawings and in the specifications.
2. Documenting all plumbing tests, certifications, and inspections.
3. Verifying the completeness and appropriateness of operation and maintenance manuals, as-built drawings, spare parts lists, special tools lists, and other items as may be specified for support of the plumbing systems and equipment.
4. Verifying the operation and maintenance training sessions with the Owner’s personnel for all plumbing systems and equipment.

1.4 QUALITY ASSURANCE

A. Codes, Regulations and Standards:

ASHRAE Guideline 0 - The Commissioning Process (most current edition)

1.5 COORDINATION

A. Coordinate all work, timing, and completion of work with other specification sections as required to ensure that preliminary commissioning can be completed early enough to allow for final commissioning and reports to be completed prior to the Owner taking occupancy of the building or space.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PARTICIPATION

A. General: The third party commissioning agency will actively participate in the construction phases of the project to ensure compliance with the drawings and specifications and with all commissioning requirements specified in this and other specification sections as relate to commissioning of the plumbing systems.

B. Pre-Construction Meeting: The third party commissioning agency, the general contractor, mechanical contractor, temperature controls subcontractor, test and balance subcontractor, and all other associated subcontractors shall attend the pre-construction meeting(s) and then coordinate the requirements for plumbing systems commissioning throughout construction of the project.

C. Commissioning Meetings: The third party commissioning agency, the general contractor, mechanical contractor, temperature controls subcontractor, test and balance subcontractor, and all other associated subcontractors shall attend the regularly scheduled commissioning coordination meetings and then coordinate the requirements for plumbing systems commissioning throughout construction of the project

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) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing fixtures specified in this section include the following:

Water Closets
Urinals
Lavatories
Mop Sinks
Sinks
Showers
Drinking Fountains

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. 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. 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.

B. 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.

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 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 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.

Wall mounted urinals
Drinking fountains

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, 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.

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 his own expense.

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 EXTRA STOCK

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 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.9 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) 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. Thrust Blocks
4. Basic Valves
5. Hose Bibbs
6. Hydrants
7. Reduced Pressure Backflow Preventers
8. Point-of-Use Mixing Valves
9. Electronic Mixing Valves
10. Emergency Eyewash/Shower Assemblies
11. Water Hammer Arrestors
12. Trap Primers
13. Electronic Trap Primers
14. Expansion Tanks for Potable Water
15. Commercial Clothes Washers

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. 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 Size 2 inches and Smaller: Copper tube; Type L, hard drawn temper; with wrought copper fittings and solder joints.
      b. Pipe Size 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. Below Grade Pipe 3 inch and Smaller: Copper tube; Type K, hard drawn temper; with wrought copper fittings and with brazed joints.
      b. Below Grade Pipe 4 inch through 12 inch: Polyvinyl chloride (PVC) water pipe; Class 150, DR-18, with cast iron or ductile iron fittings, and ring-tite joints. Pipe shall be listed as AWWA C900.
   3. Water Piping Below Building Slab and/or other Concrete Slab:
      a. Below Grade Pipe 2 inch and Smaller: Copper tube; Type K soft copper; with no fittings.
      b. Below Grade Pipe 2-1/2 inch and Larger shall be one of the following:
         1) Copper tube; Type L, hard drawn temper; with wrought copper fittings and brazed joints.
         2) Schedule 80 PVC with socket fittings and solvent cemented joints.
         3) Polypropylene (PP-R) SDR 7.4 pipe, with socket-fusion, butt-fusion, fusion-outlet, or electro-fusion fittings and joints.
   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.

2.3 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.

2.4 BASIC VALVES

A. Provide valves complying with Section 220500 (Basic Materials and Methods for Plumbing) and in accordance with the following listing:
   1. Check Valves (All Sizes): Swing check valves
   2. Gas Isolation Valves (All Sizes): Lubricated plug valves
   3. Valves at connections to appliances shall be Milwaukee BA-300, or approved equal.

B. Pressure Reducing Valves:
   1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following, or approved equal:
      Watts Model 223-S-B
      Zurn Model 500XLYSBR
   2. Pressure reducing valves shall comply with ASSE Standard 1003.
   3. Pressure reducing valves shall be provided with the manufacturer's upstream strainer, and with an integral bypass capability. Provide upstream and downstream pressure gauges, and a full size valved bypass at each pressure reducing valve location.
   4. Pressure reducing valve size shall be as indicated on the drawings, and/or as appropriate for the associated maximum water flow. Pressure reducing valves for closed hot water and chilled water system make-up shall be 1 inch unless indicated otherwise on the drawings. Provide parallel valves for water flows that are beyond the capacity of a 3 inch pressure reducing valve.
   5. Valve Body shall be lead free brass or bronze. Valve end connections shall be threaded for valve sizes 2-1/2 inch and smaller, flanged for 3 inch valves.
   6. Valves shall be rated for an initial pressure of 150 psi. Valves shall be selected for inlet and outlet pressures as indicated on the drawings.

C. Pressure Compensating Flow Limiting Valves
   1. Provide pressure compensating flow limiting valves where shown on the drawings. Valves shall provide shutoff, measurement, and flow limiting functions, and shall be NSF-61-G and NSF-372 certified for use in a potable water system.
   2. Valves shall be all brass construction with one male thread end with a brass ball valve, and one union end.
   3. Valves shall include a removable stainless steel flow cartridge and a stainless steel spring.
   4. Valves shall be rated for a minimum of 300 psi at 250°F, shall have a flow control accuracy of plus or minus 5%, and shall have a control range of between 2 and 60 psi.
   5. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      Pro Hydronic Model AFLB (No Lead)
      IMI Flow Design Model ICSS (No Lead)

2.5 INTERIOR HOSE BIBBS

A. Where located on interior walls hose bibbs shall be Woodford Model 24 with polished bronze body, chrome plated, renewable composition disc, tee key handle, 3/4 inch inlet and hose outlet, with non-removable non-freeze vacuum breaker. Specific to Toilet rooms A114T, B107T and B118T provide HB-1 Woodford model MB24 Modular Box with model 24P keyless hose bibb. Provide with 2-1/2 gpm flow restrictor.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hose bibbs which may be incorporated in the work include the following, or approved equal:
   Woodford
   Watts

2.6 EXTERIOR HOSE BIBBS

A. Non-Freeze Wall Hydrants: Woodford Model B65 automatic draining wall hydrant with flush mounted wall box, polished brass finish, tee handle key, length to suit wall thickness, hinged locking cover, 3/4 inch inlet and hose outlet, with non-removable non-freeze vacuum breaker.

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

2.7 REDUCED PRESSURE BACKFLOW PREVENTERS

A. Provide reduced pressure backflow preventers consisting of a complete assembly, including ball type shutoff valves on inlet and outlet, strainer on the inlet, and an oversized air gap fitting with drain piping routed to the exterior of the building (terminating with a downspout nozzle). Backflow preventers shall include test cocks and a pressure differential relief valve located between two positive seating check valves. Air gap fitting sizes shall be as follows:

1” and 1-1/2” backflow preventer: 3” air gap fitting and drain piping
2” and 2-1/2” backflow preventer: 4” air gap fitting and drain piping
3” and 4” backflow preventer: 6” air gap fitting and drain piping

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering backflow preventers which may be incorporated in the work include the following, or approved equal by Apollo or Watts:

Zurn Wilkins Model 375XL or BF-475 (depending on water line size and flow)

2.8 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, 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 Model 270-LF
Symmons Model 7-225-CK-MS
Kohler Model K-99799-NA

2.9 ELECTRONIC MIXING VALVES

A. Provide electronic mixing valves of type and size as noted on the drawings. Electronic mixing valves shall be digital electronic type complying with ASSE 1070. Electronic mixing valves shall be Leonard Model PNV or approved equal, with size as scheduled on the drawings, or based on system flow requirements if not scheduled.

B. Electronic mixing valves shall include an LED display and a plumbing dashboard diagram with status indicating LED’s.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering tempered water control valves which may be incorporated in the work include the following, or approved equal:

Leonard Valve Company
Lawler Manufacturing Company
Armstrong International

2.10 EMERGENCY EYEWASH AND/OR SHOWER ASSEMBLIES

A. Provide emergency eyewash and/or shower assemblies, of type, size, and location as indicated on the drawings. Assemblies and installation shall comply in all regards with ANSI Standard Z358.1.

B. Provide electronic mixing valves of type and size as noted on the drawings. Electronic mixing valves shall be digital electronic type complying with ASSE 1071. Electronic mixing valves shall be Leonard Model ENV-6100-LF, or approved equal, and shall be set to deliver tepid water between 80°F and 90°F (see drawings for required temperature setting).

C. Isolation valves in cold water and hot water piping serving emergency eyewash and/or shower assemblies shall be provided with lockout/tagout devices. Lockout/tagout devices shall be manufactured by Seton, Condor, Brady, or approved equal.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering emergency eyewash/shower mixing valves and assemblies which may be incorporated in the work include the following, or approved equal:

Leonard
Haws
Bradley

2.11 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:

Sioux Chief 650 Series
Mifab CL Series
Precision Plumbing Products SWA or SC Series

2.12 TRAP PRIMERS

A. Provide pressure drop activated or electronic trap primers of type and quantity indicated on the drawings. Trap primer piping located in a concrete floor slab shall be Type ‘L’ soft copper with no joints, wrapped with corrosion protection tape, Shurtape PW100 Corrosion Protection Tape, or approved equal.

2.13 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. Ball valves with lockshield shall be Crane Model D171, or approved equal.

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

2.14 COMMERCIAL CLOTHES WASHERS

A. Provide a backflow preventer in the main cold water line serving a single commercial clothes washer or multiple commercial clothes washers.

B. In the cold water piping line serving each commercial clothes washer provide an isolation ball valve, a manual balancing valve, and a high capacity water hammer arrestor.

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. Provide water branch lines at single fixtures with a manufactured water hammer arrestor.

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.

C. Install piping on room side of building insulation.

D. 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.

E. 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 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 BACKFLOW PREVENTERS

A. Install backflow preventers where indicated on the drawings. Where drain pans are shown on the drawings, pipe drain pan outlet to the nearest floor drain or floor sink.

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 SPARE PARTS

A. Furnish to the Owner, with receipt, one valve key for each key operated hydrant, hose bibb, and faucet installed.

3.7 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.

3.8 TESTING OF PIPING

A. Test piping in accordance with the following schedule. Show no loss in pressure or visible leaks after a minimum duration of four hours at the test pressures indicated.

TEST SCHEDULE

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.

END OF SECTION

SECTION 22 10 10 - 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) 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 221000 (Facility Water Distribution) 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. Peroxidically cured EPDM elastomeric sealing element rated to 300 psi with a temperature range of 0°F thru 250°F. Sealing element shall be uniform in size/thickness and shall be free from manufactured deformities or indentations.
   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, or approved equal.

B. Approved Tool Manufacturers for Installation of Press-Connect Fittings
   1. Viega, Milwaukee, and/or Rigid.

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.

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.

3.3 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) 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 Drain and Vent Piping
Grease Waste Piping
Underground Building Drain Piping
Underground Piping Corrosion Protection
Condensate Drain Piping
Trap Primers
Cleanouts
Floor Drains and Floor Sinks
Miscellaneous Drains
Sump Pumps

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 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. 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. 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: Comply with the latest edition of CISPI Standard 301-18, CISPI Standard 301-21, CISPI Standard 310-12, 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. At the Contractor's option vertical piping above floor from lavatories and sinks may be standard weight galvanized steel pipe with class 125 black cast iron fittings, drainage pattern, with screwed joints.
3. Two-Band Couplings: Provide couplings with 2 stainless steel clamps, stainless steel bolts and nuts, and neoprene gasket in conformance with ASTM C1540 for heavy duty shielded couplings. Couplings shall be Husky Model SD-2000, Ideal Tridon Heavy Duty, or approved equal.
4. Four-Band Couplings: Provide couplings with 4 stainless steel clamps, stainless steel bolts and nuts, and neoprene gasket in conformance with ASTM C1540 for heavy duty shielded couplings. Couplings shall be Husky Model SD-4000, Ideal Tridon Heavy Duty, or approved equal. Four-band couplings shall be installed on all exposed piping in mechanical and storage rooms. Four-band couplings shall also be installed over critical care and other sensitive areas including, but not limited to, kitchens and dining rooms.

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.

C. Grease Waste Piping

1. Grease waste piping shall be hubless cast iron. For above ground grease waste piping provide two-band or four-band couplings per Section 2.2 (A2 and A3). For below ground grease waste piping provide four-band couplings per Section 2.2 (B3).

D. 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.

E. 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.

2.3 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-1440A.
2. Cleanouts in walls: Zurn Z-1446-A with stainless steel access cover.
3. Cleanouts at exterior of building: Zurn Z-1440.
   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

2.4 FLOOR DRAINS AND FLOOR SINKS

A. Provide floor drains of size and type as scheduled and shown on the drawings, including the listed options or features. Provide a membrane flashing clamp and frame at floors with a waterproofing membrane.

B. Set the top of each drain slightly below the floor to ensure drainage. Install drains in accordance with the manufacturer's written instructions and in the locations indicated on the drawings. Install a vented P-trap with a 1/2" trap primer connection below each drain.

C. 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:

1. Floor Drains (Restrooms & General Service): Zurn Z-415B
2. Floor Drains (Mechanical Rooms): Zurn Z-550Y (with sediment bucket)
3. Floor Drains (Kitchens): Zurn ZN-550Y
4. Floor Drains (Showers): Zurn Z-415B-CP
5. Floor Sinks (Mechanical Rooms): Zurn Z-566Y (with half grate)
6. Floor Sinks (Kitchens): Zurn ZN-1900K2 (with half grate)

2.5 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 pipe connection.

2.6 PLASTER INTERCEPTORS

A. Furnish and install Zurn plaster interceptor 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 Model Z-1180

2.7 SUMP PUMPS (ELEVATOR)

A. Provide sump pumps where shown and/or scheduled on the drawings.

B. All equipment shall be mounted as detailed on the drawings.

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 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 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.

3.4 INSTALLATION OF CLEANOUTS

A. Cleanouts: Install in piping as indicated, as required by the Uniform Plumbing Code, at each change in direction of piping greater than 135 degrees, at maximum intervals of 50 feet for piping 4 inches and smaller, at maximum intervals of 100 feet for piping 5 inches 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.

3.5 INSTALLATION OF TRAP PRIMERS

A. Install trap primers per the manufacturer’s installation instructions, with 1/2 inch Type L hard drawn copper piping to trap primer connection on floor drains and floor sinks where indicated on the drawings.

3.6 INSTALLATION OF PUMPS

A. Install pumps where indicated, in accordance with manufacturer's published instructions, complying with recognized industry practices to ensure that pumps comply with requirements and serve intended purposes.

B. Provide access space around pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Piping shall be supported from the building structure so as to prevent any strain on the pump casings. A final check for perfect alignment of the piping connections shall be made after pump has been secured to its base. Provide valves, accessories, gauges, flexible connections, and supports as indicated.

D. Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish a copy of the manufacturer's wiring diagram to the electrical contractor.

E. Verify that electrical wiring installation is in accordance with manufacturer's submittal and the installation requirements of Division 26. Do not proceed with equipment startup until the wiring installation is complete and correct.

F. Check alignment, and where necessary, realign shafts of motors and pumps within the tolerances recommended by the pump manufacturer.

G. Lubricate pumps before startup. Perform startup in accordance with the manufacturer's written instructions.

H. Pumps shall not be connected to piping before piping is thoroughly flushed and cleaned of all dirt and grit. After piping connections have been made, systems shall be filled before starting pumps. Pumps shall not be run dry under any circumstances.

3.7 TEST OF PIPING

A. Test piping at completion of rough-in, in accordance with the following schedule. Show no loss in pressure or visible leaks after a minimum duration of four hours at the test pressures indicated.

TEST SCHEDULE

SYSTEM TESTED	TEST PROCEDURE	TEST WITH
All Soil, Waste, Drain, & Vent Piping; All Storm Drains within the building. Minimum height of standpipe shall be 10 feet above piping being tested.	Fill with water to top of highest vent and allow to stand 4 hours or longer 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.

3.8 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Section 220500 (Basic Materials and Methods for Plumbing).

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 15 00 - FACILITY NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of piping systems and specialties specified in this section include the following:

Steel Gas Pipe
Polyethylene Gas Pipe
Miscellaneous Piping Materials/Products
Gas Pressure Regulating Valves
Flexible Connections
Emergency Fuel Shutoff Valves
Hangers and Supports

1.3 QUALITY ASSURANCE

A. Welders' Qualifications:
   1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.

B. Heat fusion qualifications:
   1. Heat Fusion Joining: Qualify procedures and operators in accordance with the requirements of Title 49 of the Code of Federal Regulations as it applies to heat fusion.

C. Manufacturers: Firms regularly engaged in manufacture of supports and anchors of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
   1. Plumbing Code Compliance: Comply with applicable portions of the Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products.
   2. ANSI Compliance: Fabricate and install natural gas piping in accordance with ANSI B31.2 (Fuel Gas Piping).
   3. NFPA Compliance: Fabricate and install natural gas systems in accordance with NFPA (National Fuel Gas Code).
   4. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.
   5. Comply with applicable codes pertaining to product materials and installation of supports and anchors.
   6. UL and FM Compliance: Provide products which are Underwriters Laboratories listed and Factory Mutual approved.

1.4 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of pipe, support, anchor, and seal listed in this section.

B. Welding Certifications: Submit certifications and reports for welded piping work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide pipe and tube, joint type, grade, size, and weight indicated for each service, and complying with governing regulations and industry standards.

B. All piping, valves, and accessories shall be specifically listed and approved for use with natural gas.

2.2 BELOW GRADE POLYETHYLENE GAS PIPE

A. Polyethylene Pipe, PE2406. Pipe and fittings shall meet the requirements of ASTM D2513.

B. Fittings and accessories shall be as manufactured and furnished by the pipe supplier. Fittings shall meet the requirements of ASTM D2513, as mandated by CFR 49 Part 192.59 and is so marked, according to Part 192.63.

2.3 WELDING MATERIALS

A. Except as otherwise indicated, provide welding materials as determined by the Contractor as required to comply with all installation requirements and to comply with Section II, Part C of the ASME Boiler and Pressure Vessel Code.

2.4 PIPE AND PIPE FITTINGS

A. Gas Piping (Outside the Building Below Grade)
   1. All Pipe Sizes: Polyethylene Pipe, PE2406.
   2. Polyethylene pipe fittings and accessories shall be manufactured and furnished by the polyethylene pipe supplier. Fittings shall meet the requirements of ASTM D2513, complying with CFR 49 Part 192.59, and shall be marked according to Part 192.63

B. Gas Piping (Outside the Building Above Grade and Building Distribution Piping)
   1. Pipe sizes 2 inches and smaller shall be Schedule 40 black steel pipe with threaded fittings.
   2. Pipe sizes 2-1/2 inches and larger shall be Schedule 40 black steel pipe with butt and/or socket weld fittings.
   3. Gas piping of all sizes routed inside a building at a pressure that exceeds 2 psi shall be welded Schedule 40 black steel pipe with wrought steel butt and/or socket weld fittings.

C. Gas Piping (Below a Concrete Floor Slab)
   1. Install gas piping that is located below a concrete floor slab in accordance with UPC Section 1210.1.6. Gas piping that is located below a concrete floor slab shall be flexible stainless steel with a polyethylene sleeve, Omega TracPipe P-II, or approved equal. Fittings connected to the Omega TracPipe P-II flexible gas piping shall be by the same manufacturer as the pipe. Pipe and fittings shall be installed in conformance with the manufacturer's written instructions. The gas piping sleeve shall be vented to the outdoors in compliance with UPC Section 1210.1.6.1.

2.5 PIPING SPECIALTIES

A. Comply with Section 220500 (Basic Materials and Methods for Plumbing)

Pipe Escutcheons
Pipe Sleeves
Sleeve Seals
Unions and Flanges

2.6 BASIC GAS VALVES

A. Gas Valves: Valves 4 inch and smaller shall be Nibco T-FP-600A, Apollo 94ALF-A, or approved equal. Valves 5 inch and larger shall be worm gear operated, Resun Figure R-1431-WGA, Nordstrom Figure 149, or approved equal. Gas valves shall be CSA/AGA and ASME listed.

B. Appliance Gas Valves: Provide a gas valve at each connection to an appliance. Appliance gas valves shall be Nibco GB1A, Milwaukee BB2 Series, or approved equal. Gas valves shall be CSA/AGA and ASME listed.

2.7 GAS PRESSURE REGULATING VALVES

A. Provide single stage, steel jacketed, corrosion resistant gas pressure regulators with atmospheric vent, elevation compensator with threaded ends for 2 inches and smaller, flanged ends for 2-1/2 inches and larger, for inlet and outlet gas pressures, specific gravity, and volume flow indicated on the drawings. All gas pressure regulators shall be ANSI/CSA approved.

B. Install as indicated and comply with all utility provider requirements. Pipe atmospheric vent to outdoors, full size of outlet. Install a gas shutoff valve upstream of each pressure regulating valve.

C. Gas pressure regulating valves shall be installed such that the pressure regulator vent is a minimum of 3 feet from any doors, openable windows, foundation vents, crawlspaces, electrical panels, phone and/or cable tv conduits, etc. The pressure regulator vent shall also be a minimum of 5 feet from any powered air intakes, evaporative coolers, make-up air louvers, etc.

2.8 EMERGENCY GAS SHUTOFF VALVES

A. Provide emergency gas shutoff valves where shown on the drawings. Valves shall be listed by either UL or FM and by either AGA or CSA, and shall be capable of being installed in either a horizontal or vertical position. Valve sizes 1/2” through 3” shall be Asco Series S261, AGS Model GSV, or approved equal. Valve sizes 4” and 6” shall be AGS Merlin, or approved equal.

B. A strainer shall be installed upstream of each emergency gas shutoff valve. Strainers 3 inch and smaller shall be Titan YS-12-CI, or approved equal, with 40 mesh strainer and Buna gasket. Strainers 4 inch and larger shall be Titan YS-61-CS, or approved equal, with 40 mesh strainer and Buna gasket.

2.9 SEISMIC GAS SHUTOFF VALVES

A. Provide seismic gas shutoff valves where shown on the drawings. Install seismic gas valves immediately outside the gas service entrance to each building. Seismic gas valves shall be California (Koso) Valve manufactured by Pacific Seismic Products, with Model MS monitoring switch, or approved equal. The monitoring switch shall be wired to activate an audible/visible alarm. Audible/visible alarm horn/strobe shall be Amseco Model CSHB-BG with blue light lens, or approved equal by Kele & Associates. The alarm horn/strobe shall be located on the building exterior adjacent to the seismic gas valve, mounted at 7’-6” above finished grade. The gas piping immediately adjacent to the seismic gas shutoff valve shall be secured to the building with Unistrut channel bracing and a Unistrut Series P1100 pipe clamp.

2.10 FLEXIBLE CONNECTIONS

A. Provide flexible connections in gas piping at all equipment, including but not limited to, boilers, water heaters, furnaces, rooftop units, kitchen equipment, and clothes dryers. Flexible connections shall be as Metraflex Model GASC, Mason Industries Model CSAMN, Unisource Series 400, or approved equal. Flexible connections shall be CSA approved.

PART 3 - EXECUTION

3.1 INSTALLATION OF GAS PIPING

A. Install piping 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.

B. Comply with ANSI B31 Code for Pressure Piping.

C. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly and apply to only male threads of metal joints.

D. Remove cutting and threading burrs before assembling piping.

E. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped, or damaged.

F. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping or equipment connections are completed.

G. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection. Provide listed isolation fitting above grade prior to entry into building. Provide independent ground systems for above ground and below grade.

H. Install drip legs in gas piping where indicated and where required by code or regulation.

I. Install tee fitting with bottom outlet plugged or capped at bottom of pipe risers.

J. Install gas piping with 1/64 inch per foot (1/8 percent) downward slope in direction of flow.

K. Maintain minimum of 12 inch clearance between gas piping and steam piping above 200°F.

L. Install magnesium anodes for underground steel pipe, one 5 lb anode for up to 100 feet in length and one 5 lb anode for each additional 100 feet.

M. Locate piping runs, except as otherwise indicated, 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 shortest route which does not obstruct usable space or block access for servicing building and its equipment.

N. Hold piping close to walls, overhead construction, columns, and other structural and permanent enclosure elements of the building, limit clearance to ½ inch where furring is shown for enclosure or concealment of piping, locate insulated piping for a 1 inch clearance outside of the insulation. 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 on the drawings.

O. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pans under piping that must be run through electrical spaces and in all other locations indicated on the drawings.

P. Should structural difficulties or work of other contractors prevent the running of pipes or the setting of equipment at the points shown, the necessary deviations therefrom, as determined by the Contractor, with the Architect/Engineer's review, will be allowed but must be made without additional cost to Owner.

Q. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.

R. Install exposed polished or enameled connections from fixtures or equipment with special care, showing no tool marks or threads at fittings.

S. Cap or plug openings in piping and fittings immediately to exclude all dirt until fixtures are installed or final connections are made.

T. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used.

U. 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.

V. 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.

W. Install piping subject to expansion or contraction in a manner permitting strains to be evenly distributed and alleviated by expansion loops installed as required.

X. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeve.

Y. Install polyethylene pipe where indicated on the drawings in accordance with ASTM D2774 ‘Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping’ and as required by the manufacturer's installation instructions.

1. Polyethylene pipe fittings shall be joined in accordance with the pipe manufacturer’s instructions.
2. Connection of plastic pipe with metal pipe shall be only outside underground with ASTM D2513 category I transition fittings.
3. Gas pipe risers to above grade, shall be metallic and shall be wrapped or coated to a point at least six inches above grade.
4. When riser connects underground to plastic pipe, the underground horizontal metallic portion of the riser shall extend at least 30 inches before connecting to the plastic pipe.
5. Heat fusion joints shall be made in accordance with qualified procedures that have been established and proven by test to produce gas tight joints at least as strong as the pipe or tubing being joined. Joints shall be made with the joining method recommended by the pipe manufacturer.
6. Plastic pipe shall be buried with an electrically continuous corrosion resistant tracer wire (minimum 14 AWG) and tape to facilitate locating. One end of the wire and tape shall be brought above ground at a riser.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Section 220500 (Basic Materials and Methods for Plumbing).

3.3 INSTALLATION OF PIPING SYSTEM JOINTS

A. General: Provide joints of type indicated in each piping system.

B. Cut all steel pipe by power hacksaw, a circular cutting machine using an abrasive wheel, or in square end vise by means of hand hacksaw. Wheel cutters may be used for steel pipe provided that the pipe shall have ends reamed to full inside diameter and beveled before being made up into fittings. Pipe shall have round edges or burrs removed such that a smooth and unobstructed flow will be obtained.

C. Thread pipe in accordance with ANSI B2.1, cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, RectorSeal No. 5, or approved equal, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Teflon tape may be used on piping 1-1/2 inches and smaller.

D. Use joint compound, same as specified for threaded pipe joints, on all cleanout plugs.

E. Weld pipe joints in accordance with recognized industry practice and as follows:
   1. Welding shall be done by qualified welders in a first class, workmanlike manner, conforming to the American Standard Code for Pressure Piping ANSI B31.1 and B31.1A.
   2. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
   3. Do not weld out piping system imperfections using tack welding procedures. Re-fabricate piping to comply with requirements.

3.4 INSTALLATION OF FLANGED JOINTS

A. Match flanges within piping system and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

3.5 INSTALLATION OF PROTECTIVE PIPE WRAP

A. Protect all steel pipe buried in ground from corrosion by the application of protective pipe wrap. Clean and prime pipe before application of the wrapping material.

3.6 INSTALLATION OF DETECTABLE UNDERGROUND WARNING TAPE

A. Protect all underground gas and/or fuel oil piping systems (when shown on the mechanical and/or plumbing drawings) with a detectable underground warning tape, as manufactured by Seton, or approved equal. This requirement applies to metallic and non-metallic piping (including polyethylene piping).

B. Detectable underground warning tape shall consist of 5 mil foil tape printed with associated pipe service (e.g., ‘Caution Gas Line Below’).

C. Tape shall be buried approximately one half of the pipe buried depth. Tape buried up to 24” deep shall be a minimum of 3” wide. Tape buried greater than 24” deep shall be a minimum of 6” wide.

3.7 INSTALLATION OF GAS PRESSURE REGULATING VALVES

A. Install as indicated on the drawings and comply with all utility provider requirements. Pipe atmospheric vent to outdoors, full size of outlet. Install a gas shutoff valve upstream of each pressure regulating valve.

B. Gas pressure regulating valves shall be installed such that the pressure regulator vent is a minimum of 3 feet from any doors, openable windows, foundation vents, crawlspaces, electrical panels, phone and/or cable tv conduits, etc. The pressure regulator vent shall also be a minimum of 5 feet from any powered air intakes, evaporative coolers, make-up air louvers, etc.

3.8 INSTALLATION OF GAS PIPING EQUIPMENT CONNECTIONS

A. Connect gas piping to each gas fired equipment item, with drip leg, gas shutoff valve, and flexible connection. Comply with the equipment manufacturer's instructions. Gas shutoff valves shall comply with UPC Section 1212.6 to be within 6 feet of the equipment and shall be installed no higher than 5 feet above finished floor.

3.9 PIPE CLEANING

A. Purge all newly installed natural gas piping with compressed air.

3.10 TEST OF PIPING

A. Test piping at completion of rough-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

SYSTEM TESTED	TEST PRESSURE	TEST WITH
Gas Piping	100 psi	Air

B. Testing equipment, materials, and labor shall be furnished by this Contractor.

C. 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.

3.11 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 that are installed as part of this work. Leave systems and equipment in a satisfactory operating condition.

3.12 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.13 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 23 00 - HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing) are hereby made a part of this section.

1.2 SUMMARY

A. Types of heat tracing specified in this section include the following:

Self-regulating, parallel resistance heat tracing with capacity, design, and accessories as scheduled on the drawings.

1.3 SUBMITTALS

A. Provide the following for each type of product.
   1. Shop drawings for electric heating cable.
   2. Field quality control reports.
   3. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL RESISTANCE HEATING CABLES

A. Manufacturer shall be as follows, or approved equal:
Raychem/nVent
Chromolox
Thermon

B. Comply with IEEE Standard 515.1 (Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications).

C. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in cross-linked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, non-heating leads with connectors at one end, and seal the opposite end water-tight. Cable shall be capable of crossing over itself once without overheating.

D. Electrical Insulating Jacket: Flame-retardant polyolefin.

E. Cable Cover: Tinned-copper braid and polyolefin outer jacket with ultraviolet inhibitor.

F. Maximum Operating Temperature (Power On): 150°F.

G. Maximum Exposure Temperature (Power Off): 185°F.

H. Electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70 by a qualified testing agency, and marked for the intended location and application.

2.2 CONTROLS

A. Provide Raychem ‘ProtoNode’, or approved equal, and C910 485 and ACS 30 controllers, as required for a complete and functional system with a BACnet Interface.

B. Provide an outdoor air temperature sensor with a 40°F setpoint.

C. Provide a remote temperature sensor for applications that require pipe temperature sensing.

2.3 ACCESSORIES

A. Cable Installation Accessories (Provided by Heat Tracing Manufacturer): Fiberglass cloth adhesive tape, Rayclic-PC power connection, RayClic-S splice kits, RayClic-T tee kits, and Rayclic-E end seals. Also provide Rayclic-SB-04 mounting brackets for installations involving fluid temperatures above 150°F, and for all grease waste piping.

B. Warning Labels: Continuously printed 'Electrical Heat Tracing' vinyl labeling, 3 mil minimum thickness, with pressure sensitive, permanent, waterproof, self-adhesive back.

1. Markers on pipes with outside diameter including Insulation of less than 6 Inches shall be 3/4 inch minimum width.
2. Markers on pipes with outside diameter including Insulation of 6 Inches and larger shall be 1-1/2 inch minimum width.

2.4 GREASE WASTE PIPING

A. When shown on the drawings heat tracing for grease waste piping shall be installed and configured to maintain a 110°F pipe temperature. Install insulation over piping with electric heating cables according to Specification Section 220700 (Plumbing Systems Insulation).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electric heating cable across expansion joints according to manufacturer's written instructions; use slack cable to allow movement without damage to cable.

B. Install electric heating cables after piping has been tested and before insulation is installed.

C. Install electric heating cables according to IEEE Standard 515.1 (Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications).

D. Install insulation over piping with electric heating cables according to Specification Section 220700 (Plumbing Insulation).

E. Install warning tape on piping insulation where piping is equipped with electric heating cables.

F. Set all field adjustable switches and circuit breaker trip ranges.

G. Ground equipment according to the requirements listed in Division 26.

H. Connect wiring according to the requirements listed in Division 26.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform tests after cable installation but before application of coverings such as insulation, wall, or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe mounted cables.

C. Cables will be considered defective if they do not pass the listed tests and inspections.

D. Prepare and submit test and inspection reports.

E. Remove and replace damaged heat tracing cables.

END OF SECTION

SECTION 22 34 00 - GAS FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. Sections 220000 (Plumbing) and 220500 (Basic Materials and Methods for Plumbing) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of plumbing equipment specified in this section include the following:
Gas Fired 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 the 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 startup instructions, capacity and ratings, with selection points clearly indicated.

B. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include troubleshooting maintenance guides. Include this data in maintenance manual.

PART 2 - MATERIALS

2.1 GAS FIRED WATER HEATERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering gas fired water heaters which may be incorporated in the work include the following, or equal:
Lochinvar Shield
State
AO Smith

B. The water heater shall be capable of full modulation firing down to 20% of rated input with a 5:1 turndown ratio and shall have a minimum 95% thermal efficiency.

C. The water heater shall consist of a direct fired stainless steel heat exchanger mounted on top of a glass lined storage tank in a fashion that will reduce the amount of scale build-up that is known to reduce efficiency. The water heater shall have no visible pipes that connect the heat exchanger to the storage tank. Heat exchangers shall bear the ASME ‘HLW’ stamp and shall be National Board listed. There shall be no banding material, bolts, gaskets or O-rings in the header configuration.

D. The stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built in trap shall allow condensation to drain from the heat exchanger assembly. The water heater shall carry a three year warranty against leaks and a one year parts warranty.

E. The water heater shall bear the ASME 'HLW' stamp and shall be National Board listed. The tank shall have a working pressure of 150 psi. The tank shall be glass lined and fired to 1600°F to ensure a molecular fusing of glass and steel. The tank shall be completely encased in high density insulation of sufficient thickness to meet the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The tank shall be fitted with a brass drain valve.

F. The water heater shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.10.3 test standard for the US and Canada. Water heater shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 standard. The water heater shall be certified for indoor installation. The water heater efficiency shall be verified through third party testing by AHRI and listed in the AHRI Directory.

G. The water heater shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The water heater shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating water heater firing rates for maximum efficiency. The water heater shall operate in a safe condition at a de-rated output with gas supply pressures as low as 4 inches of water column.

H. The water heater shall utilize a 24 volt control circuit and components. The control system shall have an electronic display for water heater set-up, water heater status, and water heater diagnostics. All electronic circuitry shall be easily accessed and serviceable from the front of the jacket. The water heater shall be equipped with; an all-bronze circulating pump; high limit temperature control; ASME certified temperature and pressure relief valve; inlet & outlet water temperature sensors; flue temperature sensor; runtime contacts; alarm contacts; low water flow protection, contacts for louvers, security protection, adjustable pump delay, enable/disable contacts and built-in freeze protection. The manufacturer shall verify proper operation of the burner, all controls, and the heat exchanger connecting to water and venting prior to shipping.

I. Provide equal flow manifold for piping entering and leaving multiple water heaters. The manifold shall be provided by the manufacturer as a standard option for the specified water heaters.

J. The water heater shall feature a programmable smart control with an LCD display, soft key pad, pump delay with freeze protection, and pump exercise. The water heater shall be equipped with an eight foot power cord. Supply voltage shall be 120 volt/1 phase.

K. The water heater shall be installed and vented with a vertical or sidewall direct vent system. The vent and combustion air material shall be sealed stainless steel or sealed polypropylene routed separately and terminating with the manufacturer's specified termination fitting for both the vent and combustion air. The vent and combustion air materials shall be UL listed for use with the water heater. Note that polypropylene does not conform to ASTM E84 with regard to a 25/50 flame spread and smoke developed rating and cannot be installed in a return air plenum.

L. The water heater shall be approved for 180°F operation.

M. The water heater shall have an independent laboratory rating for Oxides of Nitrogen (NO_x) of 20 ppm or less, corrected to 3% O_2.

N. The water heater shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.

O. The water heater firing control system shall be direct spark ignition with electronic supervision.

PART 3 - EXECUTION

3.1 INSTALLATION OF GAS FIRED WATER HEATERS

A. Install power gas-fired water heaters as indicated, in accordance with the manufacturer's installation instructions and in compliance with all applicable codes.

B. Furnish wiring diagram to the electrical installer. Refer to Division 26 for wiring requirements.

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, test, and adjust water heaters in accordance with the manufacturer's startup instructions. Check and calibrate all controls.

E. All water heaters shall be secured in place with two straps as required by Uniform Plumbing Code Section 507.2.

3.2 TRAINING

A. Provide a minimum of 2 hours of training and orientation of the Owner’s staff in proper care and operation of all equipment.

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, 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
2018 International Building Code
2018 Uniform Mechanical Code
2018 Uniform Plumbing Code
2018 International Energy Conservation Code
2017 National Electrical Code
2018 International Fire Code
2018 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 these codes and regulations.

C. When the Contract Documents differ from governing codes, furnish and install the larger size or higher standards called for 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 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. 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.

C. 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.

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. 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. Partial or incomplete sets of equipment and materials submittals will not be acceptable.

G. Assessment of quantities is solely the Contractor's responsibility and will not be reviewed.

H. 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.

I. 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.

J. 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.

K. Electronic Formatted Submittals

1. Provide submittals in electronic form (.pdf file format).
2. Identify and incorporate submitted information as follows:
    a. Provide complete submittal package including cover sheet with:
        1) Project Name
        2) Submittal Package Number (with Revision Number identified)
        3) Date
        4) Name and Address of Architect/Engineer
        5) Name of Contractor
        6) Name of Subcontractor
    b. Group submitted items by specification section and provide:
        1) Index of submitted products with page numbers
        2) Name of firm or entity that prepared submittal
        3) Name of supplier
        4) Name of manufacturer
        5) Equipment and/or fixture tag, if applicable
        6) Number and title of appropriate specification section
3. 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. Provide originally submitted sheet with Architect/Engineer comments. 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 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 IECC 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 manufacturer's name and model number. Remove unidentified materials and equipment from site.

B. Equipment specified by manufacturer's number shall include all accessories, controls, etc. listed in catalog as standard with equipment. Furnish optional accessories as specified.

C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged. Replace 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.

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 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 this Contractor from 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 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.

3.4 ACCESS

A. 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.

3.5 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 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.

3.7 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.

3.8 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.

3.9 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.

3.10 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 above.

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, Contractor will be required to redo balancing tests and tabulations entirely.

E. During test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in first class operating condition.

F. Mark final positions of balancing valves after balancing is complete.

G. All areas of building shall receive proper flow of hot and chilled water to assure adequate and uniform temperatures throughout.

H. Final observation will not be made until all of the above have been completed and balance report has been submitted and reviewed.

3.11 POST CONTRACT COMPLETION TESTS

A. If the required full load operation conditions cannot be conducted at the time of the 'Project Completion Tests and Start-Up' 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.

3.12 PRE-SEASON START UP

A. Within one year of filing of the Notice of Substantial Completion, when all full load tests required under 'Project Completion Tests and Start-Up' 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.

3.13 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.

3.14 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

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and Section 230000 (Heating, Ventilating, and Air Conditioning) are 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. Materials
2. Valves
3. Valve Boxes
4. Hangers and Supports for HVAC Systems
5. Seismic Bracing for HVAC Systems
6. Flow Meters
7. Access Doors
8. Roof and Wall Flashings
9. Cathodic Protection
10. Thermometers
11. Pressure Gauges
12. Unions and Flanges
13. Pipe Escutcheons
14. Pipe Sleeves
15. Sleeve Seals
16. Low Pressure Strainers
17. Penetrations in Fire and Smoke Rated Partitions
18. Pipe Anchors and Guides
19. Flexible Hose Expansion Loops
20. Piping and Equipment Identification
21. Detectable Underground Warning Tape and Tracer Wire
22. Painting
23. Concrete Work
24. Electric Motors
25. Electric Motor Starters
26. Flexible Connections
27. Pre-Fabricated Roof Curbs
28. Welding

B. Types of valves specified in this section include the following:

- Ball Valves
- OS&Y Valves
- Check Valves
- Butterfly Valves
- Manual Balance Valves
- Automatic Pressure-Compensating Flow Limiting Valves
- Motor-Operated Valves
- Air Vent Valves
- Solenoid Valves
- Emergency Fuel Shutoff Valves
- Tempering Valves
- Pressure Relief Valves
- Pressure Reducing Valves

C. Types of flow meters specified in this section include the following:

- Heat Pump Loop Flow Meters
- Make-Up Water Flow Meters
- Domestic Water Flow Meters

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 manufacture of piping specialties and valves, 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 same manufacturer.

C. Identification: Provide piping specialties and valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

1.5 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each type of manufactured piping specialty and valve. Include pressure drop curve or chart for each type and size of valve, control valve and balancing valve.

B. Operation and Maintenance Data: Submit operation and maintenance data and spare parts lists for each type of manufactured piping specialty and valve. 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 MATERIALS

A. 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 the Contractor's option. Unless otherwise indicated, valves shall be same size as the upstream pipe size.

2.2 VALVES

A. Provide valves as shown on drawings and other valves necessary to segregate branches and equipment.

B. Furnish discs suitable for the service intended. Furnish a brass tag for each valve identifying the service controlled. Properly pack and lubricate valves per manufacturer’s recommendations. Place a union adjacent to each threaded valve. Provide two unions at soldered valves. Furnish the flow performance curve for each valve.

C. Provide flanged valves in welded pipe.

D. Provide ball valves in water lines unless otherwise shown.

E. Valves shall be full size of pipe, manufactured by Nibco, Milwaukee, Apollo, or equal, in accordance with the following listing:

Ball Valves	2" and below	Nibco T-585-70-66	Milwaukee BA-400S
Butterfly Valves	2-1/2" and above	Nibco LD-2022	Milwaukee HL-233E
OS&Y Valves	2-1/2" and above	Nibco F-667-O	Milwaukee F-2894-M
Check Valves	2” and below 2-1/2" and above	Nibco T-453-B Nibco F-968-B	Milwaukee 508 Milwaukee F-2970-M
Gas Valves	4” and below 5” and above	Nibco T-FP-600A Nordstrom 149	Apollo 94ALF-A Resun R-1431-WGA

F. Ball Valves: All ball valves shall have stainless steel ball and stem, PTFE packing, and throttling handle. Provide motor-operated ball valves where indicated on the drawings. Motor-operated ball valves shall be Belimo B2 Series, or approved equal.

G. Butterfly Valves: All butterfly valves shall be lug style ductile iron body, with EPDM seats, aluminum bronze disc, stainless steel stem, and throttling handle with memory stop. Provide handles for shutoff service, and infinite position throttling capability, with indicator plates for balancing. Provide motor-operated butterfly valves where indicated on the drawings. Motor-operated butterfly valves shall be Belimo F6 Series, or approved equal.

H. Lockshield valves shall be lead-free ball type with locking lever, Nibco T-585-80-LF-LL, Crane D171LS, or approved equal.

I. Globe valves and their trim shall be selected for the specific service that they are associated with. Globe valves shall be Nibco F-718-B, Milwaukee 2981-M, or approved equal.

J. Gate valves and their trim shall be selected for the specific service that they are associated with. Gate valves shall be Nibco NP450, Milwaukee 1140, or approved equal.

K. Manual Balance Valves (2” and Below): Fixed port venturi style, Pro-Hydronic CBV Series, IMI Flow Design AccuSetter UA Series, Pro-Hydronic CBVF Series, Taco Accu-Flo, Bell & Gossett Circuit Setter Plus, Nibco T-1810, or approved equal. Variable orifice balancing valves are not acceptable.

L. Manual Balance Valves (2-1/2” and Above): Fixed port venturi style, Pro-Hydronic CBVF Series, 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.

M. Automatic Pressure-Compensating Flow Limiting Valves: Valves shall be Pro-Hydronic Model AFLB, IMI Flow Design Model AC, Hays Mesurflo Model 2517, Nibco Model T-1880, or approved equal. Include removable stainless steel cartridge, union, and test ports. Field adjustable type valves shall be Bell & Gossett Ultra Setter, Oventrop Cocon QTZ, or approved equal.

N. 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.

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 system in which installed.

P. Tempering Valves: Provide tempering valves as 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.

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 Section IV of the ASME Boiler and Pressure Vessel Code and ANSI Z21.22 where 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. Valves shall be Watts Series 174A, Series 374, Series 740, or approved equal.
3. Combined Pressure and Temperature 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 listing requirements for temperature and pressure discharge capacity. 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, or approved equal:

   Watts
   Bell and Gossett
   Spirax Sarco

R. Pressure Reducing Valves
   1. Pressure reducing valves shall comply with ASSE Standard 1003.
   2. Pressure reducing valves shall be provided with the manufacturer's upstream strainer, and with an integral bypass capability. Provide upstream and downstream pressure gauges, and a full size valved bypass at each pressure reducing valve location.
   3. Pressure reducing valve size shall be as indicated on the drawings, and/or as appropriate for the associated maximum water flow. Pressure reducing valves for closed hot water and chilled water system make-up shall be 1 inch unless indicated otherwise on the drawings. Provide parallel valves for water flows that are beyond the capacity of a 3 inch pressure reducing valve.
   4. Valve Body shall be lead free brass or bronze. Valve end connections shall be threaded for valve sizes 2-1/2 inch and smaller, flanged for 3 inch valves.
   5. Valves shall be rated for an initial pressure of 150 psi. Valves shall be selected for inlet and outlet pressures as indicated on the drawings.
   6. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include the following, or approved equal:

      Watts Model 223-S-B
      Zurn Model 500XLYSBR

S. Emergency Fuel Shutoff Valves: Asco Series S261 (gas), Asco Series SV401 (fuel oil), or approved equal.

T. General Purpose Solenoid Valves: Asco Series 8210, or approved equal.

U. All 4 inch and larger valves located 10 feet or higher above finished floor shall be provided with chain operators.

2.3 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.

2.4 HANGERS AND SUPPORTS FOR HVAC SYSTEMS

A. See Specification Section 230530 (Hangers and Supports for HVAC Systems).

2.5 SEISMIC BRACING FOR HVAC SYSTEMS

A. See Specification Section 230540 (Seismic Bracing for HVAC Systems).

2.6 FLOW METERS

A. Flow Meters for Heat Pump Loop Hydronic Systems: When shown on the drawings, provide electromagnetic style flow meters, Rosemount Model 8700, Onicon Model F-3000, 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.

2.7 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 18 inch by 24 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 which offer access doors that may be incorporated in the work include the following, or approved equal:

Milcor
Best Access Doors

2.8 ROOF AND WALL FLASHINGS

A. Flashing for penetrations of the roof for mechanical items such as flues and ducts will be furnished and installed under other sections of these specifications. The work of this section shall include layout, sizing, and coordination of penetrations required for the mechanical work. Furnish and install counter-flashings above each flashing required in the mechanical work. Flues and ducts shall have 24 gauge galvanized sheet metal storm collar securely clamped to the flue or duct above the flashing.

2.9 CATHODIC PROTECTION

A. Furnish and install dielectric unions at all locations described herein, whether shown on Drawings or not, and except as noted herein. Construct couplings and flanges 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 plastic threaded in standard pipe sizes.

B. Make up the flanges with insulating components consisting of a hard, phenolic gasket, bolt sleeves, and bolt washers. Supplement the insulating gasket with neoprene faces to form a seal.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work include the following:

Maloney
Walter C. Vallet

2.10 THERMOMETERS

A. Thermometers shall be of the bimetal helix type, Miljoco Model B5099A, 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
Heat pump well field supply and return mains at each header.	25° to 125°F

D. Thermometers used for air temperature in ductwork, plenums, etc., shall have a perforated guard over the stem suitable for sensing air temperature. Stem length shall be 9 inches minimum.

E. 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.

F. Thermometer wells with chain and cap shall be provided as spares wherever spare wells are indicated on the drawings.

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. The most common gauge selections will be for ranges of 0 to 160, 0 to 60, and/or 0 to 30 psi.

2.12 UNIONS AND FLANGES

A. Furnish and install unions at each threaded or soldered connection to all equipment, tanks and valves, of type specified in following schedule:

Type of Pipe	Union
Steel pipe 2" and smaller	150 lb screwed malleable ground joint, brass to iron seat, black for black piping, galvanized for galvanized piping.
Screwed steel, black or galvanized 2-1/2" and larger	125 lb cast iron screwed 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
Screwed black or galvanized steel pipe 2-1/2" and larger	125 lb cast iron screwed flange flat faced, black or galvanized as required, unless noted otherwise.
Welded steel pipe 2-1/2" and larger	150 lb forged steel welding flanges, 1/16" raised faced, unless noted otherwise.

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.

2.13 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

2.14 PIPE SLEEVES

A. Where pipes pass through a concrete floor slab 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 and the concrete has been poured, 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 concrete floors or walls install a Schedule 10 galvanized metal sleeve providing between a 1/2 inch and 1 inch 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 in accordance with the applicable UL fire rating system.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe sleeves which may be incorporated in the work include 3M, or approved equal.

2.15 SLEEVE SEALS

A. Provide sleeve seals for sleeves located in foundation walls below grade or in exterior walls as follows:

1. Pipe Sleeves through foundations & walls below grade: 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 water-tight seal.
2. Available Manufacturers: Subject to compliance with requirement, manufacturers offering mechanical sleeve seals which may be incorporated in the work include the following, or approved equal:

   Thunderline Link-Seal
   Calpico

2.16 LOW PRESSURE STRAINERS

A. Provide wye or basket 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 drain fitting. 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 strainers 4" size and larger.

B. 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:

   Metraflex
   Taco
   Bell & Gossett
   Watts

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 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, 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.
   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.

2.18 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. In cases where space constraints require a smaller footprint, the Contractor may utilize the Metraflex V-Loop product upon written approval from the Architect/Engineer.

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. The weld procedure qualification record shall be used to document the execution of this 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.

H. 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 ASME 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. 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 DETECTABLE UNDERGROUND WARNING TAPE AND TRACER WIRE

A. Protect the following underground piping and conduit systems (when shown on the mechanical and/or plumbing drawings) with a detectable underground warning tape, as manufactured by Seton, or approved equal.

1. All gas piping.
2. All heat pump ground loop piping.
3. Temperature control communication conduits.

B. Detectable underground warning tape shall consist of 5 mil foil tape printed with associated pipe service (e.g., 'Caution Gas Line Below').

C. Identify heat pump ground loop piping with tracer wire. Tracer wire shall consist of #10 AWG wire with HDPE jacket and shall be located no more than 12" above the horizontal piping. The use of THHN is not permitted for use as tracer wire.

D. At contractor's option, detectable underground warning tape shall consist of a No. 12 AWG solid copper tracer wire embedded in a 12 mil woven polyethylene jacket. The jacket shall be water and corrosion resistant, able to be elongated up to 500% before breaking, with custom colors and labeling.

E. The depth of the marking tape shall not be less than 18", shall not exceed half the depth of the pipe, and shall be installed in strict accordance with the manufacturer's written installation instructions.

1. Tape buried up to 24" deep shall be a minimum of 3" wide.
2. Tape buried greater than 24" deep shall be a minimum of 6" wide.

F. The methodology for locating the installed detectable underground warning tape shall be demonstrated 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 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.

2.24 ELECTRIC MOTORS

A. Electric motors larger than 1/2 horsepower (hp) rating shall be, 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 hp 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 $\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 hp 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 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 single phase control transformers.

2.26 FLEXIBLE CONNECTIONS

A. Flexible Connections (Pumps)
   1. Provide flexible connections that are 9 to 14 inches long where indicated on the drawings and/or as required to accommodate movement or vibration of the piping system.
   2. Flexible connections shall be all stainless steel with carbon steel flanges. Flexible connections shall be rated for no less than 160 psi working pressure at 70°F. Flexible connections shall be Twin City Hose Model TCHS, or approved equal.

B. Flexible Connections (Air Handling Units)
   1. Provide flexible connections that are 9 to 14 inches long where indicated on the drawings and/or as required to accommodate movement or vibration of the piping system.
   2. Flexible connections shall be all stainless steel with carbon steel flanges. Flexible connections shall be rated for no less than 160 psi working pressure at 70°F. Flexible connections shall be Twin City Hose Model TCHS, or approved equal.

C. Flexible Connections (Rooftop Units, Fan Coil Units, Heat Pumps, Motorized Equipment)
   1. Provide 18 inch long flexible connections where indicated on the drawings and/or as required to accommodate movement or vibration of the piping system.
   2. Flexible connections shall be all stainless steel with carbon steel ends. Flexible connections shall be rated for no less than 370 psi working pressure at 70°F. Flexible connections shall be Twin City Hose Model HPH, or approved equal.

2.27 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. 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.

C. 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.

D. 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.

E. Where gauge is not indicated fabricate units of 14 gauge metal.

F. Sloping Roof Decks: Where the finished roof slope is less than 1" per foot, provide tapered wood nailers (treated wood) at top of support units to form a level top edge.

G. Provide pressure-treated wood nailer, not less than 1-5/8" thick and of not less than width of support wall assembly. Anchor nailer securely to top of metal frame unit.

H. Install 2-1/2” thick rigid insulation in the roof curb assembly just below the wood nailers and insulate the inside of roof curb structural support walls with R-30 fiberglass batt insulation (see the mechanical equipment curb detail on the drawings for additional information and requirements).

I. For deck slopes of 1" per foot or more, fabricate support units to form a level top edge.

J. 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

2.28 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 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.

3.2 INSTALLATION OF LOW PRESSURE STRAINERS

A. Install low pressure strainers full size of connected piping in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2 inches and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow-down 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 control valves
Pressure reducing valves
Temperature and/or pressure regulating valves

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. See Specification Section 230530 (Hangers and Supports for HVAC Systems). Where special hanger/support of piping or ductwork is detailed or shown on the drawings, the drawings shall be followed.

3.4 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 union at each connection to equipment and downstream of each valve. Provide unions at both ends of valves when valves cannot be turned due to an obstruction.

D. 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 packing to stop leaks; replace valve if leak persists.

E. 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.

3.5 INSTALLATION OF UNIONS AND FLANGES

A. Install unions and flanges so that piping can be easily disconnected for removal of tanks, equipment, and valves. Provide a minimum of two unions at each three-way valve.

3.6 INSTALLATION OF EXPANSION ANCHORS

A. Where permitted in other sections of this specification, expansion anchors may be used in hardened concrete.

B. Job testing: Load test 50 percent of the expansion anchors on each job to twice 80 percent of the ICBO recommended allowable load in tension for that particular anchor, except that if the design load is less than 75 pounds, only one anchor in ten need be tested. If any anchor fails, then test all anchors. Perform the load test in the presence of the Building Inspector.

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 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. Where shown on the temperature control diagrams, the temperature control subcontractor shall furnish and install remote panel-mounted thermometers. Duct-mounted thermometers may be omitted at these locations.

C. Thermometers shall be placed at all locations shown on the drawings.

D. 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.

E. Thermometers provided as part of the temperature control work and located on a control panel need not be duplicated by the requirements listed above.

3.9 INSTALLATION OF GAUGES

A. Provide gauge connections at the following locations:
Suction and discharge of geothermal bore field pumps.
Inlet and outlet of butterfly type balancing valves.
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 may be shown on the drawings.

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.

3.10 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 2.9 of this specification.

H. Pipe Marking Schedule:

Legend	Color
Heat Pump Supply and Return Water	White on Gray

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. Bore field circuit piping in the mechanical room shall be labeled to coincide with the GPS numbering of the bore field

3.11 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.

3.12 DEMOLITION WORK

A. Unless specifically indicated otherwise, demolition work shall include removal of all associated equipment, electrical/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.

3.13 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.

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. 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 voltage 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.
   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 such equipment shall be delivered to the electrical contractor for mounting and connecting to power wiring. 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.

C. 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 factory before shipment.

D. All electrical work and equipment, including internal wiring, must comply with applicable codes and applicable portions of electrical specifications. Route line and low voltage control wiring in conduit. Conduit for temperature control wiring shall be responsibility of the mechanical contractor and shall be of type specified in electrical specifications.

3.15 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.

3.16 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 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) are hereby made a part of this section.

1.2 WORK INCLUDED

A. This section consists of general requirements covering certain parts of the HVAC work and is supplemented by other specification sections covering additional work, requirements, and materials specifically applicable to the work of each section. Requirements of other sections of the specifications, if in conflict with these requirements, shall govern.

1.3 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:

Heating Systems
Ventilating Systems
Air Conditioning Systems
Piping Systems
Temperature Control Diagrams
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 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), 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. 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.

C. Rectangular Ducts: (10’ & 8’ maximum spacing with strap or hanger rod sizes based on duct size).

D. Round Ducts: (12’ maximum spacing with strap or hanger rod sizes based on duct size).

E. 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	
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	
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. Section Includes:
   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. 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.

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 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.

2.3 METAL 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.

2.4 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.

2.5 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:
a. B-line
b. Unistrut
c. Flex-Strut
d. G-Strut
e. 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.

2.6 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:
1. Pipe Shields
2. nVent/Caddy
3. Buckaroos
4. Carpenter & Paterson
5. Piping Technology & Products
6. Rilco Manufacturing
7. Value Engineered Products

B. Standard Insulation Insert Material for Cold Piping: Polyisocyanurate high density insulation, with 125 psi minimum 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 psi minimum compressive strength, a flame spread/smoke developed rating of 25/50 or less; or Calcium Silicate with 100 psi minimum 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 inches beyond 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.

2.7 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 or 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:
      a. Hilti
      b. ITW Ramset/Red Head
      c. MKT Fastening
      d. 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:
   a. Hilti
   b. ITW Ramset/Red Head
   c. MKT Fastening
   d. B-line

2.8 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, but are not limited to, the following:
      a. Miro Industries
      b. PHP Systems/Design
      c. RectorSeal HVAC
      d. 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, but are not limited to, the following:
      a. Miro Industries
      b. PHP Systems/Design
      c. 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 stainless steel, continuous thread 1/2 inch rods.
   5. Horizontal Member: Adjustable horizontal, galvanized stainless steel pipe support channels.
   6. Pipe Supports: Roller strut clamps, clevis hanger, or swivel hanger.
   7. Hardware: Galvanized stainless steel.
   8. Accessories: Protection pads.
   9. Height: 12 inches above roof Insert lesser dimension above roof.

D. High 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, but are not limited to, the following:
      a. Miro Industries
      b. PHP Systems/Design
      c. Rooftop Support Systems
   2. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

3. Base: Single vulcanized rubber or molded polypropylene.
4. Vertical Members: Two, galvanized stainless steel, continuous thread 1/2 inch rods.
5. Horizontal Member: One, adjustable height, galvanized stainless steel pipe support slotted channel or plate.
6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
7. Hardware: Galvanized stainless steel.
8. Accessories: Protection pads, 1/2 inch continuous thread galvanized steel rod, 1/2 inch continuous thread stainless steel rod.
9. Height: 36 inches above roof Insert lesser dimension above roof.

E. High Profile, Multiple Pipe Stand:
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. Miro Industries
b. PHP Systems/Design
c. RectorSeal HVAC
d. 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 stainless steel channels.
5. Horizontal Members: One or more, adjustable height, galvanized stainless steel pipe supports.
6. Pipe Supports: Roller strut clamps, clevis hanger, swivel hanger.
7. Hardware: Galvanized stainless steel.
8. Accessories: Protection pads**,** 1/2 inch continuous thread rod.
9. Height: 24 inches above the roof or as indicated on the drawings.

F. 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.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment supports made from structural carbon steel shapes.

2.10 OUTDOOR EQUIPMENT STANDS

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. MIRO Industries
2. RectorSeal HVAC
3. 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.

2.11 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.

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 inches thick 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. Equipment Support Installation: Fabricate from welded structural steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. 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.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. 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.

M. 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 4 and 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 inches long and 0.048 inch thick.
      b. 4” pipe: 12 inches long and 0.06 inch thick.
      c. 4” and 5” pipe: 18 inches long and 0.06 inch thick.
      d. 8” thru 14” pipe: 24 inches long and 0.075 inch thick.
      e. 16” thru 24” pipe: 24 inches long and 0.105 inch thick.
   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 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.
   1. 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.

3.8 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are 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 inches of 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 inches of 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 36” 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 30” size , from two rods if longitudinal movement caused by expansion and contraction might 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 might occur.
   19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2” thru 42” size if longitudinal movement caused by expansion and contraction might 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 might 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 might 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 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450°F piping 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 to 450°F piping 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): 1500 lbs.
      c. Heavy (MSS Type 33): 3000 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.

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.

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.

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 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 23 07 00 - HVAC INSULATION

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) 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 System Insulation:
   Heat Pump Loop Supply and Return Piping
   Condensate Drains
   Refrigerant Piping
2. Ductwork System Insulation:
   Supply Air and Return Air Ducts
   Outside Air Intake Ducts
   Clothes Dryer Exhaust Ducts
   Kitchen Hood Exhaust Ducts
3. Equipment Insulation:
   Heat Pump Loop Pumps
   Heat Pump Loop Air Separator
   Removeable Insulating Jackets

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firm regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. 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.

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 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. General: All pipe insulation conductivities and thicknesses shall meet or exceed the requirements listed in 2018 International Energy Conservation Code Table C403.11.3. 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, in accordance with ASTM E84.

C. Kitchens: All insulated piping exposed in kitchen 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 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:
      Johns Manville, CertainTeed, 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:

   Johns Manville, CertainTeed, 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:

   Johns Manville, CertainTeed, Owens Corning

J. Closed Cell Polyisocyanurate Insulation with Aluminum Jacketing
1. Closed cell polyisocyanurate insulation shall be Johns Manville Trymer 25-50 with vapor retarder film, and aluminum jacketing, or approved equal. Install insulation and jacketing per the manufacturer's written recommendations. Conductivity shall be 0.19 at 75°F, 0.23 at 125°F, and 0.26 at 200°F. Insulation shall be rated for applications from 0°F up to 300°F. Insulation flame spread and smoke developed rating shall be 25/50 or less in accordance with ASTM E84.
2. Covering: Cover pipe and fitting insulation with Johns Manville Saranex 540-CX vapor retarder film and Saranex vapor retarder tape. Finish all cold fittings as required to provide a vapor-tight seal.
3. Jacketing: Cover pipe and fitting insulation with stucco-embossed aluminum jacketing.

K. Calcium Silicate Insulation with Aluminum Jacketing
1. Calcium silicate insulation shall be Johns Manville Thermo-1200, or approved equal, and shall be installed per manufacturer’s written recommendations. Conductivity shall be 0.36 at 125°F and 0.39 at 200°F. Insulation shall be rated for hot water, steam, or steam condensate applications up to 1200°F. Insulation flame spread and smoke developed rating shall be 25/50 or less in accordance with ASTM E84.
2. Jacketing: Cover pipe and fitting insulation with stucco-embossed aluminum jacketing.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

   Johns Manville
   Thermal Pipe Shields

2.2 HEAT PUMP LOOP PIPING (INDOORS)

A. Insulate lower level exposed heat pump loop supply and return piping with fiberglass insulation covered with aluminum jacketing and aluminum fitting covers.

B. Insulate higher level exposed heat pump loop supply and return piping with fiberglass insulation with polyurethane coated ASJ jacketing and heavy gauge pre-molded fitting covers.

C. Insulate concealed heat pump loop supply and return piping with fiberglass insulation covered with ASJ jacketing and heavy gauge pre-molded fitting covers

D. Minimum Insulation Thickness:
   1. Piping 1-1/4 inch and smaller: 1 inch
   2. Piping 1-1/2 inch and larger: 1 inch

2.3 COLD WATER MAKE-UP PIPING (OUTDOORS)

A. Insulate cold water make-up piping installed outdoors with closed cell polyisocyanurate insulation with vapor retarder film, covered with aluminum jacketing and aluminum fitting covers.

B. Minimum Insulation Thickness:
   1. Piping 1-1/4 inches and smaller: 1 inch
   2. Piping 1-1/2 inches and larger: 1 inch

2.4 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 inch

2.5 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.

2.6 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 aluminum jacketing and aluminum fitting covers secured with 3/4” wide stainless steel bands at 12” on center. Trymer 25-50 closed cell polyisocyanurate insulation is required on outdoor refrigerant piping because it does not expand and contract during weather extremes like 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.

2.7 DUCTWORK INSULATION MATERIALS

A. General: All duct insulation R-Values and thicknesses shall meet or exceed the requirements listed in International Energy Conservation Code Section C403.11.1.

B. See Specification Section 233100 (HVAC Ductwork) for additional related requirements.

C. Ductwork Insulation
   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. Unless indicated otherwise, wrap all concealed outside 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).
3. 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.
4. 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.
5. In addition to the specified seam sealing procedure, secure insulation with 16 gauge galvanized wire tied on 16" centers and within 8 inches of insulation seams.
6. Secure insulation on the underside of ducts that are wider than 24 inches 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. Galvanized wire ties are not required on any rectangular duct sections where the insulation is secured with pins and washers as outlined in this paragraph.

F. Clothes Dryer Exhaust Insulation: Insulate laundry dryer exhaust ducts throughout the building interior. Insulation shall be 3M Fire Barrier Duct Wrap 615+, Thermal Ceramics FireMaster FastWrap XL, or approved equal. Insulation shall be applied in strict accordance with the UL listing and the manufacturer's written installation instructions, including the required overlap, filament tape, and metal banding.

G. Kitchen Grease Hood Duct Insulation: Ductwork shall be insulated with two layers of flexible high temperature insulation rated to 2192°F, fully encapsulated in FSP facing. The duct enclosure system shall be UL listed per ASTM E2336 and ISO 6944 for 1 and 2 hour ratings as applicable, and zero clearance to combustibles, and tested per ASTM E84 for a flame/smoke rating less than 25/50. Insulation shall have a nominal thickness of 1-1/2 inches and a density of 6 lbs/ft^3. Insulation R-Value shall be equal to 7.3 at 75°F. Insulation shall be applied in strict accordance with the UL listing and the manufacturer's written installation instructions, including the required overlap, filament tape, and metal banding. Insulation shall be 3M Fire Barrier Duct Wrap 615+, Thermal Ceramics FireMaster FastWrap XL, or approved equal. The duct wrap manufacturer's fire rated door shall be used for duct access where shown or specified, and/or as required by code. Installer(s) of this specialty insulation product shall be factory trained or certified.

H. Kitchen Non-Grease Hood Duct Insulation: Ductwork above ceilings shall be insulated with 2-1/5 inch thick, .75 lb fiberglass insulation (Johns Manville Microlite FSK Type 75, or approved equal, with an R-value equal to 6.0). Insulation shall be applied with a non-flammable adhesive and secured with galvanized wire on 16" centers and within 8 inches of insulation seams.

2.8 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. Heat Pump Loop Equipment

1. Insulate all heat pump loop equipment which does not have factory-applied insulation, including heat pump loop pump bodies and air separators. Do not insulate heat pump loop expansion tanks.
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:

   Johns Manville
   Owens Corning

C. Removable Insulating Jackets

1. Removable insulating jackets shall be provided for the following items.

   Heat pump loop pumps.
   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 (e.g., high temperature hot water and steam 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 cold/chilled water 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:

   Insultech
   MIT International
   Thermal Energy Products

D. Ice Machines: Insulate all ice machine drain piping which does not have factory-applied insulation with fiberglass Insulation. Insulation is not required on ice machine overflow drain piping. Minimum Insulation Thickness for all pipe sizes: 1 inch.

E. Manholes and Handholes: Manholes and handholes shall be made accessible by beveling the insulation around the manhole, and covering the manhole with a removable insulating fiberglass blanket, same thickness as the adjacent equipment insulation. Manhole and handhole covers shall be finished the same as the tank covering.

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) 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, except on chilled water piping where rigid sections shall be foamglas.

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) 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:

Central Plant Equipment (Pumps, etc.)
Make-Up Air Units
Fans
Fan Coil Units
Heat Pumps (Air and Water)
Ductwork Systems
Air Distribution
Piping Systems
Balancing Valves for HVAC Systems
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-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 test & 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 submit blank copies of test sheets for all items of equipment for review by the Mechanical Engineer and CxA before testing begins.
   3. 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.
   4. 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.
   5. 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.
   6. 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. Central plant equipment: Performance data for accessory equipment, pumps, etc.
   3. Motors, pumps, and fans: Horsepower, brake horsepower, revolutions per minute, actual amperage, full load rated amperage, pump flow and head data, etc.
   4. Supply, return, and exhaust fans: CFM, static pressure, and outlet velocity.
   5. Pumps: Suction, discharge, and shutoff pressures.
   6. Heat Pumps: GPM flow and fluid temperatures, and air temperatures at inlet and outlet.
   7. Inlets, outlets, and main branch ducts: CFM and air velocity.
   8. All rooms: Air temperature during testing.
   9. Other information as required to establish completely balanced systems under design conditions.

3.2 BALANCING REQUIREMENTS

A. All air and water systems and devices shall be balanced to within +0% to +5% of design.

B. Make allowance for air filter resistance at time of tests (by false-loading the filter bank with cardboard or other suitable material such that the test results can be repeated). Test and balance all main supply and return air ducts to the design air quantities.

C. After final air and hydronic testing and balancing make necessary adjustments to obtain uniform temperatures as required during actual occupancy.

D. 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.

E. 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.

F. Adjust deflection of supply outlets to ensure proper and uniform air distribution.

G. 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.

H. 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.

I. 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.

J. A kitchen hood performance test per 2018 Uniform Mechanical Code Section 511.2.2.1 shall be conducted upon completion and before final approval of the installation of a ventilation system serving commercial cooking appliances. The test shall verify the rate of exhaust airflow in accordance with UMC Sections 508.5.1.2 through 508.5.1.5. The permit holder shall furnish the necessary test equipment and devices required to perform the tests (see ASHRAE Standard 154 Section 4.7.1). The permit holder shall verify the capture performance of Type I and Type II hoods. A field test shall be conducted with all appliances under the hoods operating at design capacity, and with all sources of replacement air operating at design airflows for a restaurant. Capture and containment shall be verified visually by observing smoke or steam produced by actual cooking operation or by simulating cooking using devices such as smoke candles or smoke puffers. Smoke bombs shall not be used (see ASHRAE Standard 154 Section 4.7.2).

K. See the Field Observation Checklist Example on the following page.

END OF SECTION

Field Observation Checklist (Example)			
YES	**NO**	**N/A**	
□	□	□	Is the ductwork intact?
□	□	□	Are any endcaps missing?
□	□	□	Are the access doors installed and secured tightly?
□	□	□	Are there openings in the ductwork?
□	□	□	Are any inlets or outlets missing?
□	□	□	Are the turning vanes installed correctly?
□	□	□	Is the ductwork, including fan inlets and outlets, installed according to the drawings and specifications?
□	□	□	Is the ductwork free of debris?
□	□	□	Are all duct dampers, including fire and smoke dampers, installed and accessible?
□	□	□	Are all terminal boxes, reheat coils, reheat components, etc. 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, partitions, etc. installed?
□	□	□	Are filters installed correctly and have frames that will not allow leakage?
□	□	□	Are the coils clean and properly installed?
□	□	□	Are the drive components installed?
□	□	□	Are the automatic control dampers installed in the correct locations?
□	□	□	Are the fan housings, plenums, etc. installed according to the drawings and specifications and properly sealed?
□	□	□	Are the flexible connections installed properly?
□	□	□	Are the fan wheels aligned properly with proper clearance between the fan and housing?
□	□	□	Are suitable traverse locations available?
□	□	□	Is the piping intact and free of leaks?
□	□	□	Are the pumps, piping, and equipment installed according to the drawings and specifications?
□	□	□	Are all valves, flow meters, and temperature-pressure taps installed to allow for a complete TAB?
□	□	□	Are all valves, flow meters, and temperature-pressure taps accessible?
□	□	□	Are all valves piped correctly?
□	□	□	Are all terminal unit coils installed correctly and accessible?
□	□	□	Are the terminal units piped correctly?
□	□	□	Are the piping systems free of debris?
□	□	□	Have the piping systems been cleaned and flushed?
□	□	□	Are all air vents properly installed?
□	□	□	Are vibration isolators properly installed and adjusted?
□	□	□	Are flexible connections installed properly?

Notes: This checklist is an example and shall be customized for each individual project.
N/A = Not Applicable to this project.

SECTION 23 08 10 - HVAC SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Owner's Project Requirements and Basis of Design documentation

C. ASHRAE Guideline 0-2005, The Commissioning Process.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Specification Section 01 91 13 (General Commissioning Requirements)

B. Specification Section 22 08 10 (Plumbing Systems Commissioning)

C. Specification Section 26 08 10 (Electrical Systems Commissioning)

D. All other Specification Sections in Divisions 22, 23, and 26

1.3 DEFINITIONS

A. Basis of Design (BOD): The documentation of design criteria and assumptions for systems, components, and methods chosen to meet the Owner's Project Requirements and applicable regulatory requirements, standards, and guidelines. The document includes narrative descriptions of the systems to be commissioned. The BOD is prepared by the Design Professionals.

B. Building Automation System (BAS): The automated building system providing control and user interaction with select building systems, such as the HVAC, domestic hot water and lighting systems. Also, often referred to as building management system (BMS), energy management system (EMS), or an energy management and control system (EMCS).

C. Commissioning (Cx): A quality-focused process to verify and document that building systems are installed and perform as intended per the OPR, BOD and design documents.

D. Commissioning Authority (CxA): An independent entity hired directly by the Owner to lead, oversee and review the completion of the commissioning process and tasks. The CxA is not responsible for the design or construction of the project. The CxA is the authority on commissioning process, program elements and results, and assists the construction team with coordinating and completing tasks. And reviews and witnesses the completion of the process and tasks using a sampling approach.

E. General Contractor (GC): The contractor directly contracted to the Owner with overall responsibility for the project construction and all commissioning activities described herein.

F. Functional Performance Test (FPT): A test of the dynamic function, operation and control of the equipment and systems to verify system performance to the fullest extent. Systems are tested under various operating modes and control sequences including failure modes. The FPTs are

performed using manual (direct observation) or monitoring methods. The FPTs can include sequence of operation tests, verification tests, performance tests, integrated systems tests, and trend analysis (monitoring). FPTs are often referred to as acceptance testing.

G. HVAC: Heating, ventilation, air conditioning.

H. Installation Verification (IV): Field verification and documentation of proper installation of system equipment, assemblies, and components, per design documents, manufacturer guidelines and industry standards. The IV process is typically complete when systems are ready for startup or operation.

I. Owner's Project Requirements (OPR): A document describing the operational and functional requirements of a project, the expectations of how the facility will be used and operated, and the equipment and system expectations and requirements, as defined by the Owner. This document provides an explanation of the ideas, concepts, goals, success criteria, and supporting information for the project.

J. Pre-Functional Check/Test (PFC: A check or test performed on a piece of equipment or system before, during, or after the initial startup and operation, but prior to the FPT phase. The PFC is performed to confirm, verify and document the system equipment and individual components are working properly, are controlled properly and meeting applicable performance requirements and specifications. PFC examples prior to equipment startup include pipe system hydrostatic pressure tests, verifying and documenting completion of the pipe system clean and flush, and duct leakage tests. Examples during equipment startup and operation include checking fan rotation and measuring and checking operating temperatures, pressures and motor electrical parameters. Examples after equipment startup include: the BAS control system pre-functional checks and point-to-point tests, and HVAC system TAB.

K. Startup: Initial starting or activating of equipment usually performed by the Trade Contractor or the Manufacturer's authorized representative, including applicable PFCs during the startup process.

L. Systems Manual: A manual that provides the operating staff the information needed to understand and optimally operate the commissioned systems. It expands upon the scope of traditional operating and maintenance documents and is compiled of multiple documents such as the final BOD, single line diagrams, and as-built controls drawings and sequences of operation.

M. TAB: Testing, Adjusting, and Balancing (TAB) work on the HVAC&R air and water systems to ensure design flow, pressure and temperature conditions are met. Performed by the TAB Trade Contractor.

N. Trade Contractor: A subcontractor who provides and installs specific building components and systems and/or provides certain services.

1.4 GENERAL COMMISSIONING DESCRIPTION

A. Commissioning is a quality-focused process for achieving, verifying and documenting that building systems are installed and perform functionally as intended according to the OPR, BOD, and the requirements of the design documents.

B. The work includes the completion and documentation of formal commissioning procedures by the GC, Trade Contractors, and the Manufacturer Representatives.

1. The GC and Trade Contractors shall provide the quality control for the installation, startup, checkout and testing of the systems. The commissioning process provides independent review and witnessing by the CxA (using a sampling approach) throughout the process and during qualitative functional performance testing, to observe and verify the implementation of the process, specific tasks and quality control efforts.
2. Refer to Section 019113, General Commissioning Requirements for summary description of the general commissioning process and requirements.
3. The Trade Contractors and the Manufacturer Representatives shall be responsible for participation in the commissioning process as outlined in this specification and Section 019113 General Commissioning Requirements.

C. Systems and equipment to be commissioned:

1. Central Plant Equipment
2. Variable Frequency Drives
3. Heat Pumps
4. Exhaust and Relief Fans
5. Kitchen Exhaust & Make-Up Air System
6. Destratification Fans
7. Snow Melt System
8. Electric Wall Heaters
9. BMS Controls

D. Systems and equipment not included in the commissioning are listed below. Commissioning of these systems may fall under the responsibility of the Contractor and/or the Authority Having Jurisdiction (AHJ) as noted in the specifications.

a. Walk-in cooler refrigeration systems.

1.5 COMMISSIONING TEAM

A. The Commissioning Team is comprised of the following:

1. Owner and Owner’s Representatives
2. Commissioning Authority (CxA).
3. Design Professionals
4. General Contractor (GC)
5. Trade Contractors responsible for systems covered in this section include:
   a. Mechanical Contractor
   b. Electrical Contractor

c. BAS Contractor

d. TAB Contractor

6. Manufacturer Representatives supplying equipment, materials, components and controls for the systems to be commissioned.

1.6 COMMISSIONING PROCESS

A. Submittal Reviews by the CxA

1. The CxA will review pertinent Trade Contractor submittals for the appropriate systems in the commissioning scope, concurrently with the Design Team and will provide review comments to the Design Team.

2. The GC shall provide a submittal log to the CxA for referencing the requested submittals to be reviewed by the CxA.

3. The GC shall issue the requested submittals to the CxA for review at the same time they issue the submittals to the Design Team.

4. The CxA will also use the information from the submittals to develop commissioning forms and test procedures.

B. Cx Plan and Form/Procedure Development

1. The CxA prepares a Preliminary Cx Plan either during the project final design phase or early construction phase. The Cx Plan provides guidance in the execution of the commissioning process during construction.

2. Commissioning during construction begins with a kickoff meeting conducted by the CxA where the CxA reviews the commissioning process and responsibilities with the appropriate team members. The CxA presents the Preliminary Cx Plan and discusses the project specific requirements.

3. The GC and Trade Contractors shall submit to the CxA, for review and approval, their written procedures and “blank” forms for completing all of the required Cx pre-functional tasks including (IV) Installation Verification, Startup, and PFC tasks prior to conducting any of these tasks. See Paragraph 1.9 for the submittal requirements for the contractor procedures and blank forms, including the content requirements for the procedures and blank forms. The project specific procedures and blank forms will be further described in the Cx Plan.

a. IV forms are to provide field verification and documentation of proper installation of system equipment, assemblies, and components, typically completed prior to formal Startup. Where appropriate and approved by the CxA, these forms may be combined with the Startup forms.

i. The IV forms are either supplied by the Trade Contractor and/or the Manufacturer and shall include all checklists and verification requirements from the Manufacturer’s installation and operation manual (IOM).

ii. The Trade Contractors are to verify equipment installation per the Manufacturer’s guidelines and requirements, and thus are to use and complete any applicable equipment IV checklists contained in the Manufacturer’s IOM, in

addition to any IV forms used by the Trade Contractors to verify system, equipment and assembly installation per design and industry standards.

iii. The IV forms may also contain any applicable design drawings, plans, details, or single line diagrams that will be field verified and signed off / checked by the Trade Contractor.

b. The Startup procedures and forms are either supplied by the Manufacturer and/or installing Trade Contractor and shall be used to document the completion of the formal startup procedures and associated checks and verifications during the startup and initial operation. And shall include all required startup and checkout procedures from the Manufacturer's IOM.

i. Where applicable, these forms shall include checks of the equipment internal / factory provided controls including sensors and control devices.

ii. Where required per the design specifications, the startups shall be completed by the authorized Manufacturer's representative.

c. PFC procedures and forms are Trade Contractor provided written procedures and forms used to document the completion and results for the various checks and tests performed before, during, or after startup.

i. Example PFCs include applicable refrigerant pipe tests, hydronic pipe system hydrostatic pressure tests, duct leakage tests, duct cleanness tests, hydronic pipe system flush and clean checks and documentation, hydronic water treatment tests, BAS pre-functional checks and point-to-point tests and HVAC system TAB.

4. The CxA reviews the procedures and blank forms for all IV, Startup and PFC tasks, and will issue any comments, which may include additions or changes to be made by the Trade Contractor to the forms and procedures, and/or supplemental forms may be issued by the CxA, where appropriate, to improve the forms and commissioning process.

5. The CxA will develop FPT procedures and forms and provide the draft forms to the GC and Trade Contractors for review and comment.

C. Pre-Functional Activities and Tasks

1. Meetings will be conducted throughout construction with commissioning team members, as required, to plan, coordinate, and schedule commissioning activities, review documentation, and resolve Cx issues.

2. The Trade Contractors shall perform the IV, Startup and PFC tasks for all systems and equipment (no sampling allowed), unless the contract or design documents allow for sampling of the pre-functional tests (as example, if sampling were allowed for pre-functional HVAC system duct leakage tests).

3. In general, the GC and Trade Contractors are to complete the IV prior to Startups, but where appropriate and approved by the CxA, the IV and Startup can be combined into one task.

4. The Trade Contractors shall document the completion of the IV, Startup and PFC tasks on the IV, Startup, and PFC forms.

5. The GC shall submit all completed IV, Startup, and PFC forms to the CxA for review prior to conducting the FPTs.

6. The CxA will review the completed IV, Startup, and PFC forms. The CxA will also conduct various field observations and reviews of the installation including reviews of the completed IV forms, and may witness a sample of the Startup and PFC activities. Some witnessing of the PFC activities may be performed as back-checks conducted by the Trade Contractor with the CxA, after PFC forms are complete (e.g., back-checks of the BAS pre-functional checks/tests and TAB).
7. The Trade Contractor shall resolve any IV, Startup and PFC issues or results deemed unacceptable by the CxA.
8. The CxA may create System Readiness Checklists to track the status and completion of the IV, IV, Startup, and PFC forms, including review by the CxA, prior to the FPTs.

D. Functional Performance Testing

1. FPTs are to test the dynamic function, performance and control of the equipment and systems under various modes of operation. These tests verify the correct implementation of the sequences of operation and the system performance meets the design criteria. The FPTs are performed using manual (direct observation) or monitoring methods. FPTs include the following types of tests, where applicable:
    a. Sequence of Operation Tests
        i. Sequence of operation tests are witnessed by the CxA for each unique sequence of operation but may not necessarily be repeated across identical systems, equipment or spaces, if the contractor has verified the same programmed sequence of operation code (as tested) has been programmed across multiple identical systems, equipment or spaces, based sample verification tests witnessed by the CxA.
        ii. Testing certain critical or important sequences with a higher sample rate across identical systems, equipment or spaces, beyond the individual sequence of operation tests may be required and will be determined by the CxA.
    b. Performance Tests.
        i. Performance tests are to be performed after the sequence of operation and verifications tests, and are focused on testing and verifying performance (i.e., HVAC system air and water flow rates, temperatures, pressures are achieved at both minimum and near maximum load conditions).
        ii. Examples include: a) testing VAV terminal unit maximum airflow rates and reheat coil airside temperature rise are achieved per design b) testing AHU minimum outside air ventilation rates per design are achieved at both minimum and maximum supply airflows c) testing the AHU supply airflow and temperature performance at simulated high cooling load conditions per design, d) Testing the chilled water system flow and cooling capacity performance at simulated high cooling load conditions per design.
2. The CxA will develop FPT forms that contain:
    a. Specific step-by-step procedures to execute the test in a clear, sequential and repeatable format, including any control system point value or setpoint overrides required to simulate a test condition or sequence mode.

b. The expected system response and acceptance criteria of proper performance with a Yes/No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.

c. A section for recording actual system response, notes and comments.

3. Execution of the FPTs:

a. Once the IV, Startup and PFC forms are complete, the Trade Contractors shall execute the FPTs, with the FPTs witnessed by the CxA, unless otherwise by the CxA.

b. The GC and Trade Contractors are responsible for ensuring all systems are installed, operating and performing per the requirements of the contract and design documents, and are ready for the FPTs.

c. The Trade Contractors shall determine what level of pre-testing is appropriate in order to prepare for the CxA witnessed FPTs.

d. A percent sampling approach may be used for executing the FPTs of identical systems and equipment. The approximate system sampling rates for the manual (direct observation) FPTs are defined in Part 3 of this specification and/or in the Cx Plan.

e. The acceptance criteria of FPT failures for the FPT sampling shall be zero, meaning, any FPTs that do not pass shall require the Trade Contractor to resolve the issue for all applicable systems and equipment (even those not in the original sample) and new sample rates selected for a re-test executed by the Trade Contractor and witnessed by the CxA. The CxA shall deem the FPTs acceptable after all FPTs, including re-tests, have passed and resolution of all issues completed.

f. The CxA will document the results of all FPTs on the associated FPT forms created by the CxA, unless indicated otherwise on the FPTs.

g. The Cx Plan will define any required seasonal or deferred testing.

E. Cx Issues and Recommendations

1. Throughout the process, the CxA records Cx issues, observations and recommendations on the Cx Issues Log and distributes the Cx Issues Log to the team.

2. The Cx Issues Log requires contributions and input from each of the Cx team members and as such everyone on the Cx Team has a responsibility to update the log via the agreed upon mechanism.

3. The software program and format for the Cx Issues Log will be provided by the CxA or another software program and format may be used as approved by the CxA.

4. The GC and Trade Contractors shall correct the Cx issues and recheck or retest the system(s) without delay at no additional cost to the Owner.

5. The CxA will verify the completion of the issues and recommendations via onsite reviews or witnessed retests, documentation or photographs provided by the GC and Trade Contractors, or based on information and communications provided by the GC and Trade Contractors.

F. Training Verification

1. The GC shall submit a comprehensive Training Plan with specific training agendas and materials provided by the Trade Contractors, for review by the Design Team, CxA and Owner, prior to conducting any training.
2. The Training Plan shall meet the specific requirements in the contract documents and specifications for each applicable system to be commissioned and may include both operations and maintenance (O&M) staff training and building occupant training.
3. The GC shall coordinate with the Owner and/or Owner's Representatives, as needed, regarding any specific requirements for occupant training.
4. The CxA will verify completion of the training by receiving a copy of all training class sign-in sheets and any training materials / handouts, to be provided by the GC or Trade Contractors. The CxA may also sample witness some of the training sessions.
5. The Trade Contractors will ensure all O&M manuals have been submitted to the Owner per the contract documents. The CxA may request copies of the O&M manual submittals for verification purposes.

G. Cx Report and Documentation

1. The CxA will develop the Current Facilities Requirement (CFR) document, previously called Systems Manual (per the LEED requirements), including an ongoing Cx plan, with assistance from the GC and Trade Contractors.
2. The CxA will complete the Commissioning Report and all associated documentation for the Owner with assistance from the GC and Trade Contractors.

H. Post-Occupancy Warranty Phase Commissioning

1. The CxA or O&M staff will report any identified operational or performance issues to the GC via a Warranty Phase Cx Log for resolution by the GC and Trade Contractors during or prior to the end of the warranty period.
2. The Trade Contractors shall execute any defined seasonal or deferred FPTs, witnessed by the CxA.
3. The CxA may conduct onsite visits to review system operation and performance with the Owner's O&M team and/or will review system trend data during the Warranty Phase and will report any identified issues and recommendations from the trend analysis.
4. No later than either 10 months after substation completion or two months prior to the expiration of the first 12-month warranty period of building occupancy, the CxA will return to the facility to interview facility O&M staff, walk the facility and review systems operation and trend data where applicable. Key representatives from the GC and Trade Contractors shall attend a site walk-through and meeting, as determined by the CxA.

1.7 COMMISSIONING RESPONSIBILITIES

A. General

1. The Commissioning Team and all others involved in the commissioning process shall follow the Commissioning Plan, attend the commissioning kickoff meeting, and attend additional commissioning meetings as necessary.

B. Commissioning Authority (CxA)

1. See Section 019113, General Commissioning Requirements.

C. Owner

1. See Section 019113, General Commissioning Requirements.

D. Design Team

1. See Section 019113, General Commissioning Requirements.

E. General Contractor

1. See Section 019113, General Commissioning Requirements.

F. All Trade Contractors

1. Submit project specific written procedures and blank forms for completing all IV, Startup, and PFC tasks, including manufacturer's installation checks and startup procedures, as a commissioning submittal. See Paragraph 1.9. Electronic files are acceptable.
2. Provide any equipment and construction submittals and shop drawings, including detailed sequences of operation (including any local, stand-alone controls independent of the BAS controls), complete controls points list (for all BAS, local equipment provided, and local stand-alone control points), system diagrams showing all control points, sensor locations, actuators, and controllers, and any other requested contract documentation for systems to be commissioned, as requested by the CxA. The system sequence of operation shall fully describe their equipment components and functionality, including setpoints, failure modes and alarm functions. Electronic files are acceptable.
3. Provide a list of any test metering and sensors to be used for sensor and device verification and calibration purposes. The list shall include test meter and sensor accuracy for comparison to the BAS and local control system sensor accuracy requirements specified in contract documents. All test meter and sensors shall have been calibrated within a year and have calibration documentation.
4. Attend commissioning meetings as directed by the CxA and GC to facilitate the commissioning process.
5. Assign personnel with expertise and authority to act on behalf of the Trade Contractor and schedule them to participate in and perform assigned commissioning tasks.
6. Ensure that any required manufacturer factory tests are performed and provide the factory test data and results where required.
7. Demonstrate and document proper system installation, startup and performance.
    a. Perform IV, Startup and PFC tasks for all systems and equipment (no sampling), unless the contract or design documents allow for sampling of these tasks.
    b. Ensure that any required manufacturer's representative field tests, inspections, startup and checkout of selected equipment are performed per the contract documents.

Provide completed manufacturer documentation and commissioning forms for these activities.

c. Complete all IV, Startup and PFC documentation clearly and legibly.

8. Provide a schedule and access for the CxA to witness any equipment Startup and PFC tasks. Notify the GC and CxA at least 10 days in advance of Startup and PFC tasks.

9. Address applicable Cx issues promptly. All IV, Startup and PFC issues must be resolved before the FPTs can proceed.

10. Assist the CxA in preparing the FPT procedures, clarifying the operation and control of commissioned equipment where the specifications, control drawings or equipment documentation are not sufficient for writing detailed testing procedures.

11. Review the FPT procedures to ensure feasibility, safety and equipment protection, and provide necessary written alarm limits, setpoint changes and overrides to be used during the tests.

12. Setup any control system software points, global commands, overrides of any sensor values or relays, and overrides of any setpoints or schedules, to simulate certain conditions and operating modes, in order to conduct the FPTs.

13. Configure all control settings, schedules, alarms, graphics and programming logic for all control systems and any local equipment or stand-alone controls per the project specific sequence of operations.

14. Prior to conducting the CxA witnessed FPTs, place the systems and controls into the operating modes and test and verify all sequences of operation. Check all control system safety cutouts, alarms, and interlocks with other systems during each mode of operation prior to the FPTs. Ensure all systems are operating and performing per the design requirements, and have been pre-tested per the FPTs, and are ready for the CxA witnessed FPTs.

    a. The Trade Contractors shall determine the appropriate level of pre-testing, to prepare for the CxA witnessed FPTs.

15. Perform the FPTs, with the FPTs witnessed by the CxA. Provide at least 10 days advance notice to the GC and CxA for scheduling the FPTs.

16. Setup the BAS and any other control system trends and provide all requested Trend data for the FPTs and post-occupancy warranty phase commissioning review to the CxA.

    a. As an Owner approved option, the Trade Contractors may provide the CxA remote access to the BAS and any other control system, with the Owner's permission, which will allow the CxA to easily and directly download the trend data files.

17. Prepare a training agenda for each training class for the equipment and systems to be commissioned.

18. Coordinate with the GC and Owner to schedule and plan training. Execute training of Owner's personnel per approved training agenda and schedule. Provide copies of training class sign-in sheets and materials / handouts.

19. Prepare O&M Manuals according to the Contract Documents.

20. Participate in any applicable integrated whole building tests under emergency power. This test is initiated by disconnecting the utility power to the building, and it will involve

multiple disciplines. All Trade Contractors shall participate in the FPTs as required for operation of the inter-related systems.

G. BAS Trade Contractor

1. In addition to the general Trade Contractor responsibilities outlined above, the BAS Trade Contractor responsibilities during commissioning shall also include, but are not limited to the following.
2. The BAS Trade Contractor shall support commissioning by participating in the BAS PFC Field Back-check Verifications, in which the BAS Trade Contractor reviews and demonstrates specified results to the CxA, after completing and submitting the BAS PFC forms.
    a. The BAS PFC Field Back-check Verifications shall include field review of the control system graphics, sensor / device installations and live readings, and also field demonstrations (back-check) of the pre-functional checks and tests performed by the Trade Contractors and witnessed by the CxA, for an approximate 10% to 25% sample, to be selected by the CxA for each major system, or what can be accomplished in 1 full day.
    b. Any Cx issues reported by the CxA shall be reviewed and addressed by the BAS and Mechanical Trade Contractors, and if required, the PFC forms shall be revised and resubmitted, prior to performing any FPTs.
3. The BAS Trade Contractor shall configure all BAS or local control graphics and programming logic for the sequence of operations and associated setpoints, schedules, and alarms and verify the system operation, including testing and completing the control loop tuning, prior to starting FPTs.
4. Prior to conducting the FPTs, meet with the CxA to review the programmed sequences of operation and sample system graphics with the CxA. Review to include the packaged controlled equipment with multiple installations on the project.
    a. The lead programmer from the BAS Trade Contractor shall be in attendance. For package controlled equipment, vendor manufacturer representative with programming capabilities is required to be in attendance.
    b. The intent of this requirement is to reduce field testing time by reviewing with the CxA the actual programmed sequence logic and graphics relative to the approved submittal, sequences and FPT forms, in order to confirm the actual programming and graphics prior to field testing, and to allow for any changes and adjustments.
    c. The meeting duration time is estimated to not be more than 1/2 day in duration.
5. Prior to conducting the CxA witnessed FPTs, place the systems and controls into the operating modes intended for testing. Check all control system safety cutouts, alarms, and interlocks with smoke control and fire-life safety during each mode of operation prior to functional testing. Ensure all systems are operating and performing per the requirements of the contract and design documents, and have been pre-tested per the FPTs, and are ready for the CxA witnessed FPTs.
    a. The Trade Contractors shall determine the appropriate level of pre-testing, to prepare for the CxA witnessed FPTs.

6. The BAS Trade Contractor shall provide any necessary control system global or system level commands and setpoint adjustments necessary to conduct the testing as called out in the FPT procedures
7. The BAS Trade Contractor shall set up the appropriate trends per the Trend Setup Verification forms provided by the CxA and shall provide trend data into a usable electronic format files, such as a text, CSV or Excel format, to the CxA. The CxA will analyze and review the trend data as part of the FPT. These trends shall be setup prior to conducting any sequence of operation functional tests.
    a. The trend points list may include both hardware (inputs, outputs) and virtual / software points.
    b. The appropriate trend intervals and minimum duration will be provided by the CxA either in a Trend Setup Verification form or in the FPT forms.
    c. As an Owner approved option, the BAS Trade Contractor may provide the CxA remote access to the control system, with Owner permission, that will allow the CxA to easily and directly download the trend data files.
8. The BAS Trade Contractor shall also provide trend data to the CxA during the post-occupancy warranty phase for review by the CxA, where required.
9. Participate in any applicable integrated whole building tests under emergency power. This test is initiated by disconnecting the utility power to the building, and it will involve multiple disciplines. All Trade Contractors shall participate in the FPTs as required for operation of the inter-related systems.

H. TAB Trade Contractor

1. In addition to the general Trade Contractor responsibilities outlined above, the TAB Trade Contractor responsibilities during commissioning shall also include, but are not limited to the following.
2. Provide access for the CxA to witness TAB work. Notify the GC and CxA at least 10 days in advance of TAB work.
    a. Immediately report any issues and deficiencies discovered which may affect or delay the commissioning process.
3. Submit a Draft / Preliminary TAB Report with the completed field forms and data to the Design Professional and CxA for review, within 72 hours following completion of the TAB, and prior to any TAB Field Verification conducted with the CxA (see below), and prior to conducting the FPTs.
    a. The CxA will review and provide any comments to the GC and TAB Contractor. The TAB Contractor shall respond to and address comments provided by the Design Professionals and the CxA.
4. The TAB Trade Contractor shall support commissioning by participating in the commissioning TAB Field Back-check Verifications, in which the TAB Trade Contractor demonstrates specified results to the CxA, after completion of the Preliminary TAB Report.
    a. The TAB Field Back-check Verifications shall include field demonstrations of any final setpoints and back-check measurements of the air-side and water-side systems, performed by the TAB Trade Contractor and witnessed by the CxA and/or the Design

Professional, for an approximate 10% to 25% sample to be selected by the CxA, or what can be accomplished in 1 full day.

b. If the field verification back-checks yield results that are outside the TAB tolerances for more than 5% of the sample, the TAB shall be considered incomplete.

c. Submit the Final TAB Report to the Design Professional and CxA for review after review of the Draft TAB Report and completion of TAB Field Back-Check Verifications.

1.8 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

A. Trade Contractor Pre-Functional Procedures/Plans and Blank Forms.

1. The Trade Contractors shall submit to the CxA all applicable project specific procedures/plans and blank forms for all required IV, Startup and PFC tasks for the project, at least 4 weeks in advance of performing any of these tasks. Provided below are the potential procedures/plans and blank forms required for mechanical systems, including the content requirements for each. The requirements for the project specific procedures and blank forms will be further described in the Cx Plan.

a. HVAC System IV Forms (Equipment, Ductwork and Piping) - including the following.

i. IV forms are to provide verification of the make/model, components, and accessories upon receipt of the equipment and to provide field verification and documentation of proper installation of system equipment, assemblies, and components per design and manufacturer requirements, typically completed prior to formal Startup. Where appropriate and approved by the CxA, these forms may be combined with the Startup forms.

ii. The IV forms are either supplied by the Trade Contractor and/or the Manufacturer, and shall include all checklists and verification requirements from the manufacturer's installation and operation manual (IOM). The Trade Contractors are to verify equipment installation and access per the manufacturer's guidelines and requirements, and thus are to use and complete any applicable equipment IV checklists contained in the IOM, in addition to any IV forms used by the Trade Contractors to verify system, equipment and assembly installation per design and industry standards.

iii. The IV forms shall also include any applicable design drawings, plans, details, or single line diagrams that will be field verified and signed off / checked particularly for verification of the system ductwork, piping, and coil valve connections.

iv. The IV forms shall also include any local HVAC equipment factory controls or local stand-alone HVAC controls that are not installed by the BAS Contractor.

b. HVAC System Startup Procedures and Forms - including the following.

i. The startup procedures and forms can be supplied by the installing contractor and/or the manufacturer and shall include all required startup and checkout procedures from the manufacturer's IOM.

ii. Where required per the design specifications, the startups shall be completed by the authorized manufacturer's representative. In the submittal for the startup

procedures and blank forms, the contractor shall indicate which startups will be completed by the authorized manufacturer's representative.

iii. The startup procedures and forms shall also include the checkout and verification of any local HVAC equipment factory controls or local stand-alone HVAC controls that are not installed by the BAS Contractor, including any configuration and programming checks per the project design sequence of operation.

c. Duct Leakage Test Procedures and Forms (if applicable) - including the following.

i. Floor plan drawings showing the duct section(s) to be tested.

ii. The total duct square footage for each duct section to be tested. Provide supporting calculations showing how the square footage was calculated for each duct section.

iii. The required duct leakage class (CL per SMACNA Duct Leakage Test Manual) for each duct section to be tested, per the project specifications or the SMACNA Duct Leakage Test Manual if not defined in the specifications.

iv. The intended test static pressure for each duct section.

v. The calculated allowable leakage rate (cfm) for each duct section to be tested, based on the required duct leakage class for each section, the total duct square footage for each section and the intended test pressure (calculated following the methods and equations outlined in the SMACNA Duct Leakage Test Manual).

vi. Test fan orifice certificate of calibration sheet and chart showing the orifice pressure drop and airflow (cfm).

vii. The forms to be used for completing the duct leakage tests, prepopulated with the above information and test criteria.

d. Hydronic Pipe Hydrostatic Pressure / Leak Test Procedures and Forms - including the following.

i. The sections of pipe to be tested and the associated test methods, pressures and durations,

ii. Floor plan drawings showing the pipe section(s) to be tested.

iii. The applicable forms to be used to document the completion of the pressure / leak tests.

e. Refrigeration Pipe Test Procedures and Forms - including the following.

i. The refrigeration piping to be tested, for the pipe evacuation and refrigerant charging prior to startup.

ii. The methods and procedures, equipment and gases to be used, and the test pressures and durations per the design and/or manufacturer requirements.

iii. The applicable forms to be used to document the completion of the refrigeration pipe tests.

f. Hydronic Pipe Clean and Flush Procedures and Forms - including the following.

i. The intended durations for all pipe cleaning and flushing (or pre-flushing, cleaning and flushing).

ii. The location of any temporary bypasses, permanent bypasses with valves, u-loop connections, entry and exit locations of the flush, pumping methods, velocity expected in piping to be flushed, etc., to be used.

iii. The provisions for temporary strainers in flushing systems for segments not including permanent or larger mesh strainers than indicated in contract documents.

iv. The intended water sampling or testing to be performed (such as measuring the make-up water quality and flush water quality).

v. The procedures for cleaning of the system strainers and the replacement of any construction / start-up strainers with final strainers.

vi. The product data for cleaning or disinfecting agents to be used.

vii. The product data for the corrosion inhibitors and any other chemical to be used in the final system fill (this data is provided in the water treatment procedures).

viii. The applicable forms to be used to document the completion of the clean and flush activities including actual durations and the final cleaning or replacement of the system strainers.

g. Hydronic Water Treatment Plan/Procedures - including the following.

i. The proposed chemicals, corrosion inhibitors and biocides, to be used.

ii. The water chemistry analysis and corrosion testing to be conducted.

iii. The intended final water chemistry limits or ranges (including steel, iron and copper levels) to be achieved, per the specifications and any specific manufacturer requirements, and/or any recommended deviations from the specifications and why.

iv. The timing for submitting the Water Treatment Analysis Reports for review by the Design Team and CxA.

h. BAS Controls PFC Procedures and Forms. The BAS PFCs shall include the following installation and pre-functional checks, and point-to-point tests, as described below and per the design specifications (i.e., the procedures shall include more than just point-to-point tests).

i. Installation verification of the control input and output points (sensors, actuators, relays, etc.) to verify all points have been installed per the design and the physical installation of each point has been verified.

ii. Checks of the BAS program setup/configuration parameters (i.e., point type, and range / scale) to verify the BAS parameters match the physical sensor/device parameters.

1. The contractor forms shall include columns for the checking and documenting the BAS program point type and range/scale parameters (and any other applicable parameters), and columns for checking and documenting the actual sensor/device point type and range/scale (and any other applicable parameters), as part of the procedures to verify the BAS parameters and the actual sensor/device parameters match.
2. For example, for a differential pressure analog input point, checking and documenting the BAS point type configuration is AI, DPT, 0 to 5 in w.c., 4 to 20 mA, etc., and checking and documenting the actual sensor/device type

and range/scale is a DPT, 0 to 5 in w.c., 4 to 20 mA, etc. For this example, the checks confirm the DPT input range in the BAS is indeed 0 to 5 in. (same as the actual DPT) and not 0 to 10 in.

3. For example, for a valve actuator analog output point, checking and documenting the BAS point type configuration is AO, proportional 0 to 100% open, 0 to 10 VDC, and documenting the actual valve type and range/scale is a modulating valve actuator, proportional 0 to 10 VDC, etc. For this example, the checks confirm the valve actuator output range in the BAS is indeed 0 to 10 VDC (same as the actual valve actuator) and not 2 to 10 VDC.

iii. Point-to-point tests to verify the BAS input values/reading and output commands at the system graphics matches the actual sensor/device physical reading, operation, or position.

1. The BAS Contractor shall provide written procedures as to how they are going test each point type (AO, AI, BO, BI). See below the minimum requirements to be included in the procedures for testing analog inputs and outputs. Any additional requirements per the design specifications shall also be included in the submitted procedures.
2. The forms shall include columns for the documenting the BAS input readings or output commands (at the BAS graphics), and documenting the actual physical reading, operation, or position, to verify they match or are within acceptable tolerances.
3. For analog input (AI) sensors/transmitters that are factory calibrated (no field calibration is required per the Specifications), all sensor readings on the BAS graphics shall be recorded on the forms and shall be verified as follows:
   a. If the sensor/transmitter has a local readout, then also record and verify the actual sensor/transmitter reading matches the BAS reading.
   b. If the sensor/transmitter does not have a local readout, then verify the BAS reading is within the expected range OR verify the BAS reading based on a comparison measurement using a hand-held sensor of equal accuracy (as required per the design specifications).
   c. Sensor readings that are questionable, outside the expected range shall be checked by the BAS Trade Contractor using a hand-held sensor of equal accuracy.
4. For analog input sensors that require field calibration, follow the manufacturer requirements for calibration and record the calibration results in the PFC forms, including any readings using a hand-held sensor or measurement device of equal accuracy.
5. For all terminal unit temperature sensors / thermostats, the point-to-point tests are to include disconnecting the sensor / thermostat to verify it's connected to and controlling the correct terminal unit.
6. For analog output (AO) points (e.g., actuators and VFD speeds), the points shall be physically checked to verify the commanded versus actual position or speed as follows:
   a. the commanded full (100%) open position / speed,
   b. commanded half (50%) open position / speed and
   c. commanded fully closed position (0% open) / minimum speed.

iv. Checks to verify all of the network integration points to the BAS via network interface communications (e.g., BACnet, Modbus, etc.), including both read only and writable points.

v. Checks to verify all of the control sequence programming, graphics, alarms, trend logs and network communications, including verification that all point values and adjustable setpoints are properly displayed on the system graphics and the sequence of operation programming including alarms is completed per the current sequence of operation.

i. TAB Plan, Forms and Qualifications – including the following.

i. An outline of the TAB procedures and approach for each system type. The TAB procedures and approach shall satisfy the contract documents and TAB specifications. If TAB procedures and approach are not defined in the contract documents or TAB specifications, then the TAB procedures and approach shall meet the requirements of NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems Section 7.3 (Preliminary TAB Procedures) and/or AABC National Standards Section 20.4 (Procedures).

ii. A project specific list of the BAS / EMCS control sequence of operation setpoints that will be determined by TAB, and the associated specific procedures to determine the BAS setpoints. The TAB Trade Contractor shall coordinate with the BAS Trade Contractor to obtain and review the sequence of operation.

iii. The associated TAB forms and the drawings to be used in the TAB work. The TAB drawings shall include the locations of all the designated flow control and balancing devices and all testing and measurement locations. And the TAB forms shall be pre-filled with all available project design parameters.

iv. TAB contractor qualification certificates.

v. TAB instrument calibration certificates.

j. Procedures/Plans for all other applicable mechanical systems IV and PFC tasks, per the project design and specifications or as requested by the CxA.

2. The CxA will review these submitted commissioning procedures/plans and forms including whether all project specific requirements are included.

3. The CxA may request additional data, changes and/or additions to these forms prior to their use, including forms any supplemental forms provided by CxA, based on the construction documents and specifications, manufacturer installation manuals and procedures, and/or industry standards or guidelines.

B. Training Agenda. The Trade Contractors shall develop a Training Agenda for each training session, per the requirements of the contract documents and specifications, and the LEED Enhanced Commissioning requirements, and may include both operations and maintenance (O&M) staff training and occupant training. The Training Agenda shall be included in the comprehensive Training Plan to be submitted by the GC for review by the CxA, Design Professionals, and/or the Owner (see Section 019113). The GC and Trade Contractors shall coordinate to fully develop the comprehensive Training Plan with input from the Owner.

1. The Training Agenda for each training session shall include the following:

a. equipment and/or systems covered;

b. recommended attendees;

c. proposed location;

d. estimated duration;

e. level of instruction to be provided and an outline of the training topics and subjects to be covered;

f. list of any materials and handouts to be provided (or provided in advance);

g. company to provide the training and the instructor's name and qualifications.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 MEETINGS, SCHEDULING AND COORDINATION

A. See Section 019113.

3.2 DOCUMENTATION

A. The Trade Contractors have specific responsibilities for assisting in the development of equipment check, test and verification procedures and forms, and in performing and documenting commissioning tests, as directed by the GC and as overseen by the CxA.

B. The Trade Contractors shall provide, wherever the Contract Documents require, system checks and testing, test reports, factory test data and reports, checklists, operational verifications and demonstration, etc., whether specified or not in the commissioning sections.

3.3 TEST EQUIPMENT

A. The Trade Contractors shall provide all test equipment in sufficient quantities to execute all Startup, PFC and FPT tasks in an expedient fashion.

B. The test equipment shall be of industrial quality and suitable for testing and calibration with accuracy within the tolerance necessary to demonstrate system performance per the Contract Documents. If not otherwise specified, the following minimum requirements apply:

C. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 degree F and a resolution to + or – 0.1 degree F.

D. Pressure sensors shall have an accuracy of + or – 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year.

E. The test equipment shall have calibration certification per equipment manufacturer's interval level or within one year if not otherwise specified. The calibration tags shall be affixed or certificates readily available for all test equipment.

3.4 COMMISSIONING PRE-FUNCTIONAL TASKS

A. The Trade Contractors shall conduct all IV, startup procedures and pre-functional checks/tests (PFCs) without compromise to human or equipment safety. The GC and Trade Contractors shall be responsible for the liability and safety of conducting all startup, checks and tests.

B. The Trade Contractors shall clearly identify and list any issues and deficiencies resulting from the IV, Startup and PFC tasks on the associated forms and immediately notify the CxA. The CxA will additionally document the issues on the Cx Issues Log. Once issues and deficiencies are

corrected and verified, the associated forms shall be updated and resubmitted, and any necessary field review, back-checks or re-tests witnessed by the CxA.

C. The GC and Trade Contractors shall provide a minimum 10 days' notice to the CxA for witnessing equipment Startup and PFC tasks.

D. The sample rates for the CxA witnessing of HVAC duct and pipe system PFC tasks and equipment startups, will be defined in the Cx Plan.

E. For the BAS Pre-Functional Checks and for the TAB, the CxA will witness a Field Back-check Verifications of each, as described in Part 1, Paragraph 1.7.

F. The GC and Trade Contractors shall ensure the completion of the IV, Startup and PFC forms. Review and approval of the completed IV, Startup and PFC forms by the CxA is required prior to conducting the FPTs. The CxA may create System Readiness Checklists to track the status of the IV, IV, Startup, and PFC forms, including review by the CxA, prior to the FPTs.

3.5 FUNCTIONAL PERFORMANCE TESTS

A. The Trade Contractors shall perform all FPTs per the final FPT forms, for all systems and equipment in the scope of commissioning. The FPTs shall be witnessed by the CxA, unless stated otherwise by the CxA. The Trade Contractors may need to complete off hours or weekend work in order to complete the FPTs. The CxA will document all testing results on the FPT forms.

B. As outlined in the Part 1, a sampling approach shall be used for the FPTs of identical systems and equipment, using the in the Cx Plan, with the specific systems and equipment selected by the CxA.

C. The Trade Contractors shall determine what level of pre-testing is appropriate in order to prepare for the CxA witnessed FPTs.

D. The GC and Trade Contractors shall coordinate all FPTs with the CxA, and provide a minimum of 10 days' notice prior to conducting each test.

E. The GC and Trade Contractors shall have responsibility for the liability and safety of conducting all functional performance tests.

F. The Trade Contractor executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. to execute the test according to the test procedures.

1. The Trade Contractors shall provide any necessary control system global or system level commands and setpoint adjustments necessary to conduct the testing as called out in the FPT procedures. For example, globally adjusting the space temperature setpoints for all terminal units on a floor or AHU or the building. Or as another example, globally overriding the economizer status command for all AHUs.

G. At completion of the test, the Trade Contractor shall return all affected building equipment and systems to their pre-test normal condition.

3.6 TREND ANALYSIS

A. The CxA may conduct trend analysis as part of the FPT process, after completion of the onsite field conducted FPTs and correction of all issues and deficiencies, to verify integrated system operation and performance.

B. The CxA will prepare a BAS trend points list including the trend interval. The BAS Trade Contractor shall set up the trend log definitions prior to the start of the sequence of operation FPTs.

C. The BAS Trade Contractor shall provide the trend to the CxA in an electronic format, either a text file, CSV file or Excel file, with related system parameters grouped together. The estimated duration for the trend data is 1 to 3 weeks (with a minimum of 1 weeks' worth of data).

D. If the CxA discovers any control or performance issues during trend analysis, the Trade Contractors shall correct the issues and provide new trend data for analysis verification by the CxA.

3.7 COMMISSIONING ISSUES, BACK-CHECKS AND RE-TESTS

A. When Cx issues are identified during testing, the CxA will discuss with the executing Trade Contractor and/or GC and determine whether or not testing can proceed. The CxA may allow immediate correction of minor issues and deficiencies identified during testing. The Cx issue and any identified resolution will be documented on the test form in use in addition to the Cx Issues Log.

B. The CxA will maintain and update the Cx Issues Log, and document the issue resolution process. Access to the issues log will be granted to the GC, Owner, and Trade Contractors as appropriate. The Trade Contractors shall provide updates and comments regarding issue status and resolution.

C. The Trade Contractors shall promptly correct all Cx issues. The responsible party shall correct the issue and inform the GC and CxA of the resolution and completion date, and update the Cx Issues Log accordingly (in the fields assigned for contractor updates).

D. The CxA will record completion on the Cx Issues Log after a successful witnessed re-test, field review, back-check, verification obtained through appropriate documentation or photographs, or acceptance by the Design Team or Owner. The GC shall reschedule any applicable re-testing with the CxA and Trade Contractor. The Trade Contractor shall retest until achievement of passing performance or Owner acceptance of the noted issue.

E. Where sampling is used for the PFCs and FPTs, the results shall be deemed acceptable once all noted issues are resolved and any new sample tests or checks have passed.

F. Additional parties may require input during a dispute regarding a Cx issue. Regardless of the validity or responsibility of the issue, the CxA will have the final interpretive authority on Cx issues and the Owner will have the final approval authority.

G. The CxA may recommend solutions to Cx issues. However, the GC and Trade Contractors ultimately have the burden of responsibility to solve, correct and perform required retests.

H. Back-checks, Verifications and Re-testing:

1. The CxA will witness and re-test per scope or will perform one (1) field back-check or verification of any Cx issue based on documentation provided by the trades with confirm from GC work has been completed.
2. The CxA's total onsite time for re-test witnessing and field verification or back-check of Cx issues will be limited to no more than 2 work days (full 8-hour work days) for all applicable mechanical, electrical, and plumbing or as specified in the commissioning scope.
3. The Owner may back-charge the GC for any additional fees from the CxA, resulting from any additional re-testing or field back-checks or verification beyond this allocated total time.
4. The GC must provide a minimum 48 hours' notice for scheduling any re-testing, though the CxA will attempt to accommodate a shorter timeframe if feasible.
5. Any required re-testing shall not be considered a justified reason for a claim of delay or for a time extension.
6. For any re-testing required, the CxA will determine if the entire test must be re-tested or if it is acceptable to re-test specific portions of the test that had failed.

3.8 DEFERRED & SEASONAL TESTING

A. Before or during the end of the first year warranty period, the Trade Contractor shall complete any seasonal or deferred testing, required per the design specifications and as defined in the Cx Plan. The Trade Contractors shall complete tests in the same manner as all other commissioning tests, including CxA witnessing.

1. For this project, a seasonal integrated systems and performance test of the geo thermal and heat pump system may be required, depending on the ambient conditions during the construction phase FPTs based on Cx scope.

B. The GC and Trade Contractor shall coordinate with CxA and Owner and schedule all deferred and seasonal testing.

3.9 TRAINING VERIFICATION

A. The GC and Trade Contractors shall coordinate and schedule the training for the Owner's facility and operations personnel, and building occupants. The GC shall ensure that training is completed per the requirements of the contract documents and specifications.

B. Trade Contractors responsible for specific equipment and system training shall submit to the GC, a written training agenda for each training class for the equipment and systems to be commissioned. The GC shall submit a comprehensive Training Plan, including the specific training agendas, to Owner, Team and CxA for review and approval. See also Section 019113.

C. The CxA will review the Training Plans for commissioning verification prior to conducting the actual training.

D. For verification of actual training conducted, the GC shall submit to CxA 'attendee signed' attendance sheets for each training session conducted and a copy of any final training presentations or handout materials.

3.10 COMMISSIONING ACCEPTANCE, CLOSE-OUT AND REPORTING

A. Completion of the main commissioning activities (system readiness checks, functional performance testing, and training) shall be accomplished as a prerequisite for substantial completion. Completion of any re-testing shall be completed prior to final acceptance of commissioning.

B. After completion of the main commissioning activities and following review of the completed commissioning documents, test results and the current Cx Issues Log with the Owner, the Owner will indicate whether they accept completion of the project construction phase commissioning or if not, the requirements for acceptance. Upon Owner acceptance, any remaining open Cx issues will be transferred to the warranty phase Cx Issues Log for tracking resolution and completion as part of the warranty phase commissioning.

C. Upon completion of all commissioning activities, the CxA will prepare and submit to the Owner a Cx Report detailing all completed commissioning activities and documentation. The GC shall support this effort by providing all Trade Contractor commissioning documentation.

D. The CxA will complete a Systems Manual for the systems and equipment commissioned, following the ASHREA requirements, with assistance provided by the GC and Trade Contractors. The Systems Manual will provide the operating staff the information needed to understand and optimally operate the commissioned systems. It will also include the current facility requirements, and an ongoing commissioning plan.

3.11 POST-OCCUPANCY WARRANTY PHASE COMMISSIONING

A. The Trade Contractors shall execute any defined seasonal or deferred FPTs, witnessed by the CxA, to be witnessed by the CxA, unless stated otherwise by the CxA.

B. The CxA may conduct onsite reviews of the system operation and performance, meet with the O&M Team to discuss system operation and performance, and may also review BAS trend data during the Warranty Phase. The BAS Trade Contractor shall be responsible for providing post-occupancy trend data to the CxA.

C. The CxA will report any identified issues and recommendations to the GC via a Warranty Phase Cx Issues Log for review and resolution by the GC and Trade Contractors prior to the end of the warranty period, for any issues or recommendations identified either by the CxA or the Owner. The GC shall work with the Trade Contractors and O&M staff to make corrections and adjustments as required to address the issues and recommendations.

D. Key representatives from the GC and Trade Contractors shall attend a near end of warranty commissioning review meeting, to be scheduled with the Owner's facility staff and the CxA, no later than either 10 months after substation completion or two months prior to the expiration of the first 12-month warranty period of building occupancy.

1. During this meeting, the operation and performance of the systems will be discussed with the Owner's staff, the results of any commissioning reviews and trend analysis will be discussed and the Warranty Phase Cx Issues Log will be reviewed. If needed, a walk-through of the systems with the Owner's staff will be conducted.

2. Next steps and actions items for any open Cx issues and recommendations will be discussed and documented via meeting minutes or a field report issued by the CxA. The intent is to resolve any open Cx issues prior to the end of the warranty phase.

E. After correcting noted Warranty Phase Cx issues, the GC shall notify the CxA, and the CxA will back-check and verify resolution of the issues and recommendations.

F. Issues identified during the warranty period will remain warranty phase Cx issues until satisfactory completion by Trade Contractors, even if the warranty period expires during the correction and back-check period.

END OF SECTION 230810

SECTION 23 08 20 - THIRD PARTY COMMISSIONING 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) are hereby made a part of this section.

B. Section 230810 (HVAC Systems Commissioning) is hereby made a part of this section.

1.2 THIRD PARTY COMMISSIONING AGENT CONTRACT AND PAYMENT

A. The third party commissioning agency will be contracted with and paid by the Owner.

1.3 DESCRIPTION

A. The work of this specification section includes furnishing labor and material to accomplish commissioning of the HVAC systems, including attendance at all third party commissioning meetings.

B. HVAC systems commissioning work includes but is not limited to:

1. Verifying correct operation and functional performance of HVAC systems for compliance with the ‘Design Intent’ as indicated on the drawings and in the specifications.
2. Documenting all HVAC tests, certifications, and inspections.
3. Verifying the completeness and appropriateness of operation and maintenance manuals, as-built drawings, spare parts lists, special tools lists, and other items as may be specified for support of the HVAC systems and equipment.
4. Verifying the operation and maintenance training sessions with the Owner’s personnel for all HVAC systems and equipment.

1.4 QUALITY ASSURANCE

A. Codes, Regulations and Standards:

ASHRAE Guideline 0 - The Commissioning Process (most current edition)

1.5 COORDINATION

A. Coordinate all work, timing, and completion of work with other specification sections as required to ensure that preliminary commissioning can be completed early enough to allow for final commissioning and reports to be completed prior to the Owner taking occupancy of the building or space.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PARTICIPATION

A. General: The third party commissioning agency will actively participate in the construction phases of the project to ensure compliance with the drawings and specifications and with all commissioning requirements specified in this and other specification sections as relate to commissioning of the HVAC systems.

B. Pre-Construction Meeting: The third party commissioning agency, the general contractor, mechanical contractor, temperature controls subcontractor, test and balance subcontractor, and all other associated subcontractors shall attend the pre-construction meeting(s) and then coordinate the requirements for HVAC systems commissioning throughout construction of the project.

C. Commissioning Meetings: The third party commissioning agency, the general contractor, mechanical contractor, temperature controls subcontractor, test and balance subcontractor, and all other associated subcontractors shall attend the regularly scheduled commissioning coordination meetings and then coordinate the requirements for HVAC systems commissioning throughout construction of the 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) 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	Building Control Services	(775) 826-8998

B. Furnish and install an energy management and control system (EMCS) complete with computer terminal (when specified), modem, surge suppressor, operating software, and training. Install the existing Washoe County School District (WCSD) Alerton EMCS 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. 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. All equipment controllers shall be furnished with integral hand-off-auto switches. Communication between equipment controllers and application specific controllers shall be via BACnet MS/TP network at 76.8k minimum speed.

2.2 SPARE CONTROLLER CAPACITY

A. All controllers (except application-specific controllers for VAV terminal units) 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 AND AS-BUILT DOCUMENTATION

A. 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 Control Contractor at no additional cost to the Owner.

B. Submittals shall include a complete set of the graphic displays that are intended for use on the project (a preliminary set prior to attaching data, and a live set that includes all active data after the point-to-point checkout at the beginning of the final commissioning sessions).

C. 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.

D. 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.

E. 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 of the finalized programming and a hard copy of the finalized programming (programming flow charts or line code as may be applicable) and written control sequences.

2.4 TRAINING

A. Upon completion of the commissioning process, the Temperature Control 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 two separate 4 hour sessions).

2.5 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 or programming as required/desired 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.

2.6 SOFTWARE AND PROGRAMMING REQUIREMENTS

A. Provide a security/password system with two passwords (username and password) of up to four characters each. The security/password system shall allow access based on security 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 Control 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.

2.7 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.

2.8 SPECIALTY CONTROL DEVICES AND REQUIREMENTS

A. Modulating control valves for typical heating and cooling coil applications shall be Belimo characterized control valves, B200S Series (2-way) or Belimo B300S Series (3-way) as indicated on the drawings with Belimo LRX24 actuators. Control valves for HVAC applications shall be chrome plated brass body with stainless steel ball and stem. All actuators shall include a clutch to allow manual rotation of the valve. Actuators shall be spring return type when indicated on the drawings. Modulating control valves for pipe sizes 2-1/2” and larger shall be flanged body type. Modulating control valves shall be selected for a Cv that is adequately greater than the associated coil pressure drop (see equipment schedules on drawings for coil pressure drops).

B. 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.

C. 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.

D. 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.

E. Averaging sensors and freeze sensors shall be a minimum length of 20 feet. Longer lengths and/or multiple sensors shall be provided as required to ensure adequate coverage of the entire surface of each coil. Sensor capillary shall be installed in a serpentine arrangement with coverage extending to within 6” of each coil perimeter edge (both top 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.

F. Air filter differential pressure sensors shall be Dwyer Model MS2-W102-LCD, or equal

G. Carbon Dioxide (CO_2) sensors for indoor applications shall be Vaisala Model GMW21 for wall mount applications, Model GMD20 for duct mount applications, or approved equal. There shall be no value displayed on the room sensor (only displayed on the control system remote graphic interface).

H. Carbon Dioxide (CO_2) sensors for outdoor applications shall be Vaisala Model GMP343 or approved equal (for wall mount applications). There shall be no value displayed on the room sensor (only displayed on the control system remote graphic interface).

I. Differential pressure sensors for dry applications shall be Dwyer Model MS2-W102-LCD, 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.

J. Differential pressure sensors for wet applications shall be Veris Industries Model PW2 (for wall mount applications), 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.

K. Building static pressure sensor shall have a control range of ± .10" w.c. Sensor shall be Mamac Model PR-275-R2, Dwyer Model MS2-W101-LCD, Veris Industries Model PX-01-F (fast response), Setra Model 264-0R1WB, or approved equal, and shall be furnished with indoor and outdoor reference probes.
   1. Outdoor static pressure probe shall be Dwyer Model A-306-A, or approved equal.
   2. Indoor static pressure probe(s) shall be suitable for flush mounting, shall be constructed of 10 gauge brushed aluminum, and shall be capable of sensing static pressure to within 1% accuracy when subject to air velocities of up to 1,000 fpm. Indoor static pressure probes shall be 'Shielded Static Air Probe No. 3' by Air Monitor Corporation, Paragon PE-7000 Indoor Static Pressure Probe, or approved equal.
   3. Provide a surge dampener for each indoor static pressure probe/sensor. Surge dampeners shall be Schneider Electric Model 21-153, Kele & Associates Model SD-01, or approved equal.
   4. Interconnecting tubing between sensor and indoor/outdoor probes shall be 3/8" diameter braid-reinforced pvc or polyethylene tubing. Copper tubing is required in any case where the tubing is installed in a return air plenum.

L. Audible/visible alarm horn/strobe for seismic gas valves shall be Amseco Model CSHB-BG with blue light lens, or approved equal by Kele & Associates. The alarm horn/strobe shall be located on the building exterior adjacent to the seismic gas valve (mounted at 7'-6" above finished grade).

M. Water flow meters for heat pump systems shall be electromagnetic type (Onicon Model F-3100, Rosemount Model 8700, ModMag Model M2000, or approved equal). Turbine type flow meters are not acceptable.

N. Water flow meters for heat pump system make-up water shall be ultrasonic type (Belimo Model FM075, Onicon Model F-4600, or approved equal). Turbine type flow meters are not acceptable.

2.9 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.

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 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).

E. 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 this requirement on the equipment schedules and/or in the equipment specifications).

F. Sensor wells installed in a potable water system shall be stainless steel.

G. All control dampers in stainless steel ductwork shall be constructed of stainless steel and shall have flanged connections.

H. 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.

I. 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.

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) 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

HEAT PUMP LOOP

General

The heat pump loop water pumps (P-1/P-2) are selected and intended to operate at a maximum flow of 660 gpm with all heat pump water valves open.

Occupied Mode

The lead heat pump loop water pump (P-1/P-2) VFD shall be enabled and shall be modulated between 20% and 100% speed as required to maintain the heat pump loop differential pressure setpoint (approximately 10 psi - actual pressure as determined by the test and balance contractor).

Whenever lead pump (P-1/P-2) or jockey pump (P-3) fails, the lag pump shall be enabled.

If the lead pump VFD is running at minimum speed and the differential pressure is 0.5 psi (adjustable) above the current setpoint, jockey pump (P-3) shall be enabled and the lead pump shall be disabled. The lead pump shall be re-enabled when the jockey pump (P-3) VFD is running at 100% speed and the differential pressure is 0.5 psi (adjustable) below the current setpoint.

If jockey pump (P-3) is running at minimum speed (20%) and the differential pressure is still greater than the current setpoint, the control valve in the central plant bypass shall be opened as necessary to maintain the minimum jockey pump flow (50 gpm).

If any pump is commanded on and does not see status an alarm condition shall be indicated.

If the heat pump loop water supply temperature is either below 40°F (adjustable) or above 100°F (adjustable) an alarm condition shall be indicated.

Unoccupied Mode

During unoccupied hours the jockey pump shall always be the lead pump. The jockey loop water pump (P-3) VFD shall be enabled whenever any heat pump is enabled for heating or cooling.

Whenever jockey loop water pump (P-3) fails the lead loop water pump (P-1/P-2) shall be enabled and an alarm condition shall be indicated.

HEAT PUMPS

Occupied Mode

After heat pump loop flow has been proven, the heat pump fan shall be enabled and the zone controls shall function to maintain the heating setpoint.

After heat pump loop flow has been proven, the heat pump fan shall be enabled and the zone controls shall function to maintain the cooling setpoint.

Unoccupied Override Mode

Whenever the unoccupied override pushbutton is pressed in a particular zone the associated heat pump shall be enabled to operate in accordance with the occupied mode sequence for 2 hours (adjustable). Note that during unoccupied mode hours the jockey pump is always the lead pump.

Unoccupied Mode

The heat pump loop pumps shall be enabled whenever a space reaches the unoccupied mode room temperature setpoint.

The associated heat pump control valve shall be opened whenever unoccupied heating or cooling is required. The compressor shall be enabled after the heat pump water valve is proven to be open at the end switch.

After heat pump loop flow has been proven, the associated heat pump(s) shall be enabled to reach the room temperature night low limit setpoint.

The outside air dampers shall remain closed during unoccupied mode.

Unoccupied mode heating shall be enabled whenever a room temperature falls below the unoccupied mode heating setpoint (55°F, with 3°F differential, disabled at 58°F, adjustable).

Unoccupied mode cooling shall be enabled whenever a room temperature rises above the unoccupied mode cooling setpoint (85°F, with 3°F differential, disabled at 82°F, adjustable).

Morning Warm-Up Mode

The heat pumps shall be enabled in sequence for morning warm-up at an interval of every 4 seconds (for demand limiting purposes). The room temperature sensor of the coldest zone, in conjunction with the outside air temperature sensor, shall enable the lead heat pump loop pump (P-1/P-2) utilizing optimized start programming to reach the occupied mode room temperature setpoint at the scheduled time of occupancy. Morning warm-up mode shall be limited to a maximum of 2 hours (adjustable) prior to the scheduled time of occupancy.

The zone heat pump control valve shall open through the direct digital control system controller whenever heating or cooling is required. The compressor shall be enabled after the control valve is proven open at the end switch.

After heat pump loop flow has been proven, the heat pump fan shall be enabled and the zone controls shall function to provide maximum heating.

The outside air dampers shall remain closed during morning warm-up mode.

Morning Cool-Down Mode

The heat pumps shall be enabled in sequence for morning cool-down at an interval of every 4 seconds (for demand limiting purposes). Programming for morning cool-down mode shall be essentially the same as is indicated for morning warm-up mode. Morning cool-down mode shall be limited to a maximum of 2 hours (adjustable) prior to the scheduled time of occupancy.

Safety Control

The duct mounted smoke detector shall disable the fans and dampers whenever smoke is detected and an alarm condition shall be indicated.

If either mechanical mezzanine space temperature drops below 50°F (adjustable) the associated heat pump shall be enabled (HP-5 serves Mezzanine B201M and HP-18 serves Mezzanine A201M). If either mechanical mezzanine space temperature drops below 45°F (adjustable) an alarm condition shall be indicated.

MAKE-UP AIR UNIT

Occupied Mode

Sequencing of the make-up air unit shall be accomplished by interfacing the DDC system with the make-up air unit manufacturer's controller via the associated BACnet interface. The fan shall be enabled to run continuously whenever KEF-1 is enabled, and the make-up air unit integral heating/cooling controls shall be staged/sequenced to maintain the room temperature setpoint (initially 75°F, with a 10°F deadband, cooling on at 75°F and heating on at 65°F).

The DDC system shall be interfaced with the make-up air unit to provide for occupied mode on-off control, unoccupied mode on-off control, and setting the heating and cooling setpoints. The fan shall be programmed for either continuous or intermittent operation as selected on the associated graphic display. Approximately 8 BACnet data points shall be displayed on the associated graphic screen.

Evaporative Cooler

The sump fill valve shall be open and the drain valve shall be closed whenever the outside air temperature is above setpoint (initially 60ºF, adjustable with a 25ºF deadband, sump drained at 35ºF). The sump fill valve shall be closed and the drain valve shall be open whenever the drain cycle is initiated (at 7:00 a.m. every Monday and Thursday during the summer calendar schedule). The drain cycle shall terminate 5 minutes after it is initiated. The drain cycle summer schedule calendar shall be set initially from May 1 thru September 30.

Unoccupied Heating Mode

The fan shall be enabled and the rooftop unit integral heating controls shall be staged/sequenced to maintain the room temperature setpoint (initially 55°F, with a 5°F deadband, heating on at 55°F and heating off at 60°F). Both setpoint and deadband shall be adjustable.

Override Mode

Whenever the room sensor override button is pressed during the unoccupied time period the unit shall be enabled and controlled in the normal occupied mode for a period of 1 hour (adjustable).

DESTRATIFICATION FANS

Each destratification fan shall be enabled during occupied hours. The fan speed shall be adjustable via the required BACnet interface. The associated graphic display for each fan shall include a minimum of 6 data points (specific objects to be determined during the submittal review process).

EXHAUST FANS

EF-1 thru EF-17	Enabled during scheduled occupied hours.
KEF-1	Manually enabled via local toggle switch (switch installed and wired by the temperature control contractor). Provide an engraved nameplate at the toggle switch labeled ‘Kitchen Hood Exhaust Fan’.

RELIEF FANS

Each relief fan is equipped with an EC motor and shall be programmed to operate at a fixed speed that is tested and set to maintain a positive pressure in the associated space (0.02” w.c., adjustable) as compared to outdoors. The required fan speed shall be determined by the test and balance contractor.

TRANSFER FANS

The transfer fans located in the IDF C137, MDF A132, and Electrical A131 shall be enabled whenever the associated heat pump is disabled based on the building occupancy schedule.

ELECTRIC WALL HEATERS

The electric wall heater shall be enabled/disabled as required to maintain the room temperature setpoint. Whenever the room temperature falls below 40°F and a DDC alarm shall be activated.

SNOWMELT SYSTEM

The snowmelt system shall be controlled by the manufacturer’s factory controls. The outside air temperature sensor furnished with the snowmelt system shall be installed and wired by the temperature control contractor. The sensor shall be located on a north facing wall at 7’-6” above finished grade.

DOMESTIC HOT WATER RE-CIRCULATING PUMPS

The re-circulating pump shall be enabled in accordance with the associated occupancy schedule and when the domestic hot water return temperature falls below setpoint (enabled at 90°F, with a 10°F deadband, disabled at 100°F). Both the enable setpoint and the disable setpoint shall be adjustable. An alarm condition shall be indicated whenever the pump fails (as determined by current sensor). Pumps shall be programmed for a maximum on time of 30 minutes and for a minimum off time of 5 minutes.

SEISMIC GAS VALVE

An alarm condition shall be indicated via the direct digital control system whenever the seismic gas valve indicates an alarm condition. This alarm is in addition to the local audible/visible alarm.

ELEVATOR SUMP PUMP

An alarm condition shall be indicated via the direct digital control system whenever the water level in the elevator sump reaches the high alarm level. This alarm is in addition to the local audible/visible alarm.

VARIABLE FREQUENCY DRIVES

The minimum speed on each variable frequency drive shall be set at 20% (12 Hertz). The upward and downward ramp times on each variable frequency drive shall be set at 60 seconds.

END OF SECTION

SECTION 23 09 20 - VARIABLE FREQUENCY DRIVES

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) are hereby made a part of this section.

1.2 GENERAL

A. This specification is for complete variable frequency drives consisting of a pulse width modulated (PWM) inverter designed for use with NEMA MG Part 31 inverter rated motors.

B. All VFDs installed on the project shall be from the same manufacturer.

C. The VFD manufacturer shall supply UL508/IEC Standard 61800-5 labeled drives with the options specified. To ensure continued technical and logistical support, VFDs manufactured by a third party or brand labeled will not be acceptable.

1.3 QUALITY ASSURANCE

A. Referenced Standards and Guidelines:
   1. Underwriters Laboratory 508 (A) or (C) as appropriate for Industrial Control Panels.
   2. SEMI F47-0706 for voltage sag immunity
   3. EN/IEC/CE mark 61800.3-EMC, EMI &RFI compliance.
   4. The most current adopted edition of the International Building Code (IBC) referencing ASC 7-05 and ICC AC-156.
   5. International Electrotechnical Commission 60721-3c1, 2 & 3 conformed coating on PCBs.
   6. Office of Statewide Health Planning and Development (OSHPD) approval as required.

B. Qualifications:
   1. Drives shall be UL labeled as a complete assembly. The base VFD shall be UL listed for 100 kA SCCR when installed in accordance with the manufacturer’s guidelines.
   2. VFD assembly shall be seismically certified and labeled in accordance with latest IBC.
   3. Base VFD shall have CE mark conforming to EN 61800-3 for 1st Environment level (C2).
   4. The base drive shall be SEMI-F47 certified. The drive must tolerate voltage sags from 35-50%.
   5. VFD enclosures from VFD manufacturer shall be UL rated for proper environment: 1, 12, or 3R, 4, or 4X as indicated on the drawings or herein. Cabinets shall be correctly sized for airflow and heat dissipation with an interlocked handle. Outdoor enclosures shall be constructed of steel (or non-rusting material as appropriate for the installation location) and shall include thermostatically controlled cooling fans and heaters.
   6. Factory authorized start up and owner training should be provided locally upon request. A toll free 24/365 technical support line connected to factory support personnel located in the US shall be available.

C. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering VFDs which may be incorporated in the work include the following:
   1. ABB (ACH580 Series with electrolytic capacitors)
   2. Danfoss (FC102 Series with electrolytic capacitors)

1.4 WARRANTY

A. The VFD warranty shall be for 3 years from the date of start-up and shall include all parts, labor, travel time, and expenses.

1.5 SUBMITTALS

A. Submittals shall include the following information:
   1. Outline dimensions, conduit entry locations and weights, field connection and power wiring diagrams.
   2. OSHPD preapproval, seismic certification and installation requirements where applicable.
   3. Complete technical product description with complete list of options provided. Any portions of this specification not met must be clearly indicated or the Supplier and Contractor shall be liable to provide all additional components required to meet this entire specification.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES

A. Each VFD shall provide full rated output from a line of ±10% of nominal voltage. The VFD shall continue to operate without faulting from a line of +30% to -35% of nominal voltage. VFDs shall be capable of continuous full load operation under the following environmental operating conditions:
   1. 5 to 104°F ambient temperature. Operation to 122°F shall be acceptable with a 10% reduction from VFD full load current.
   2. Altitude from 0 to 3300 feet above sea level. Operation to 6600 feet shall be allowed with a 10% reduction from VFD full load current.
   3. Humidity less than 95%, non-condensing.

B. VFDs shall have the following standard features:
   1. VFDs shall be constructed with electrolytic capacitors and dual DC chokes (no exceptions).
   2. VFDs shall incorporate an integral electrical disconnect with auxiliary contacts. The short circuit current rating (SSCR) of the integral disconnect switch shall match or exceed the SSCR of the source panel or distribution board. Coordinate with Division 26 for results of Specification Section 26 05 73.13 (Short-Circuit Studies) prior to ordering any VFD.
   3. VFDs 20 horsepower and larger shall include an additional AC line reactor (ABB Option E213, or approved equal). When the additional AC line reactor the location of the device and wiring shall be coordinated with the Architect/Engineer as part of the submittal process.
   4. All circuit boards shall be coated to protect against corrosion to meet IEC 60721-3c2.
   5. VFDs shall all have the same HMI/keypad with time clock built in. It shall be removable, capable of remote mounting, allow for uploading & downloading parameter settings, pre-programmed application macros to facilitate start-up have two user savable programs, it shall incorporate ‘bump-less transfer’ of speed reference when switching between ‘Hand’ and ‘Auto’ modes and have password protection.
   6. HMI/keypad to have Hand-Off-Auto modes, 2-4 Navigation keys, manual speed control, fault reset on it. Display shall be backlit, have a minimum of three lines, and messages shall use complete words (alphanumeric codes only are not acceptable.) Show load direction, speed, and reference or user set values in engineering units for submetering purposes (i.e., gph, kW, motor amps, frequency, speed, torque, etc.).
   7. The drive shall have the option to support a Bluetooth advanced control panel. The Bluetooth control panel shall be FCC and QDL (Qualified Design Listing) certified.
   8. VFDs shall include a coordinated AC transient surge protection system consisting of four metal oxide varistors (phase to phase & phase to ground), capacitor clamp, 1600 PIV Diode Bridge and chokes.
   9. VFDs shall have 3 to 5% impedance AC reactors or internal dual 5% DC chokes to reduce harmonics to the power line and as protection from AC line transients. VFD’s with only one DC choke shall have OEM add AC UL 508 listed and approved line reactors.
   10. VFDs shall automatically mitigate harmonics throughout the effective load range using Swinging chokes or other devices designed to lower harmonics when VFD is at partial loads. VFD’s using thin wall, small DC bus or metallic type capacitors Must add active harmonic filters to prevent high frequency harmonics from corrupting the electrical system.

11. When Active Front End (Ultra Low Harmonic) drives are specified on the schedule, they must meet the following characteristics:
    a. An IGBT based active front end shall be used for mitigation of low frequency harmonics. An LCL filter shall be installed in front of the IGBTs to remove high frequency harmonics.
    b. Limit current distortion to 3% total harmonic current distortion at full load, at the lugs of the drive.
    c. The drive shall provide full motor nameplate voltage while operating the motor at nameplate RPM. The output IGBTs must be modulating and in control of the motor during this 100% speed/load operating condition. The specified 3% current distortion and 1.0 displacement power factor shall be achievable during this operating condition.
    d. The hardware structure of the front end shall boost the DC bus voltage by 10% during low line conditions.
12. VFD's shall be CE marked and meet Standard EN 61800-3-5 for the first environment restricted level (Category C2).
13. VFD's shall be CE marked and meet Standard EN 61800-3-5 for the first environment restricted level (Category C2).
14. VFD's shall be able to have a distance from the VFD to the motor of at least 250 feet at the maximum carrier frequency complying with the drive manufacturer's installation, operating, and maintenance instructions, or provide a DV/DT filter for each VFD as necessary to protect the motors.
15. VFD's shall have a standardized control board, with all communications and I/O terminals on it, and standard building management system (BMS) communications protocols shall include Modbus RTU, Johnson Controls N2, and BACnet MS/TP. Diagnostic warning and fault information shall be transmittable over BMS, with remote fault reset when programmed. Communication options shall be available for Ethernet IP, BACnet IP, ControlNet, DeviceNet, EtherCAT, LonWorks, Modbus TCP, and Profibus.
16. VFDs shall have pass thru inputs and outputs. BMS can monitor/control VFD analog & digital I/O via communications independently of VFD functions or used for other devices/sensors.
17. VFDs shall have 250 ma of 24 VDC power for I/O and be capable of loop powering a transmitter.
18. Provide two programmable analog inputs of 0-10vdc or 4-20 ma.
19. Provide two programmable analog outputs of 0-20ma or 4-20 ma signals. Outputs proportionally programmable for: motor current, power, speed, torque, (kW) and other data.
20. Provide 6 programmable 24VDC digital inputs, able to operate normally or inverted.
21. Provide 3 programmable, Form-C relay outputs. Relay outputs shall be programmable on and off with time delay and adjustable hysteresis. Maximum switching current 8 amps at 24 VDC, and 0.4 amps at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous RMS rating of 2 amps.
22. VFD heat-sink fans shall be variable speed or thermostatically control, and shall be replaceable without removing the VFD from the wall. Operation shall be based on the temperature and run command to the drive.
23. Drive Options: All optional features shall be UL listed by the VFD manufacturer as a complete assembly and shall carry a UL508 label.
24. Provide an option for non-powered programming via laptop and adapter.
25. When indicated on the drawings provide the optional Bluetooth Advanced Control Panel. The Bluetooth control panel shall be FCC and QDL (Qualified Design Listing) certified.
    a. A free app (iOS and Android) shall replicate the control panel on a mobile device or tablet. The control panel's programming and control functionality shall function on the device. Customizing text, such as AHU-1 end switch, shall be supported by the device's keyboard.
    b. Bluetooth connectivity shall allow uploading, downloading, and emailing of parameters.

c. Bluetooth connectivity shall include two pairing modes: Always discoverable with a fixed passcode, and manual discovery with a uniquely generated passcode every pairing.

C. VFDs shall have the following programmable adjustments:
1. Three programmable fully adjustable skip frequencies, from 0 to full speed.
2. VFDs shall include a programmable time delay for start/stop with keypad indication time delay on.
3. Two independent adjustable acceleration and deceleration ramps, with 1-1800 seconds adjustable time ramps.
4. VFDs shall include a motor flux optimization circuit to automatically reduce applied motor voltage to motor to optimize energy consumption and reduce audible motor noise.
5. VFDs shall provide a programmable loss-of-load (broken belt/coupling) option to signal the loss-of-load condition via a keypad warning, relay output, and/or over BMS.
6. VFDs shall have 'Sleep' and 'Wake-Up' functions to control the VFD from the process feedback signal.
7. VFDs shall have two PID controls built in for VFD or other uses. PID controllers shall have ability for 'two zone' control. PID setpoints shall be adjustable from the VFD keypad, analog inputs, or BMS.
8. If input speed reference or remote communication is lost, the VFD shall be programmable to indicate a stop and display fault, run at a programmable preset speed, hold the VFD speed based on the last good reference received, or go to a backup control system wired to the VFD. The VFD shall also be capable to issuing a warning locally and via BMS.
9. VFDs shall have programmable ability to automatically restart after overcurrent, over or under voltage, loss of input signal or protective trip as well as number of restarts and time between.
10. VFDs shall be capable of starting into a coasting load (flying start). Forward or reverse up to full speed and accelerate or decelerate to setpoint without tripping or component damage.
11. VFDs shall include a fireman's override input that when activated shall operate in one of two modes: 1-5 fixed digital speeds ranging from 500Hz to -500Hz, or Real Time Continuous Control aka analog speed control in fireman's override PID algorithm to automatically adjust motor speed based on override setpoint and feedback. This shall override all other inputs (analog/digital, communication, and all keypad commands), except customer defined safety run interlocks, and shall force the motor to run in one of the two modes. 'Override Mode' shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command. Also, shall be programmable with up to 5 speeds selected by inputs with an at speed indication and underload capability.

D. Micro VFDs shall have the following features and programmability:
1. Microdrive's shall have HMI/keypad to have Hand-Off-Auto modes, manual speed control, fault reset on keypad, and the ability to program the VFD for all functions. Ability to save the VFD program is preferred.
2. Microdrive's shall have the ability to run on single phase of power when derated 50%.
3. Microdrive's shall have at least one analog input, and digital inputs and outputs built in when needed.
4. Microdrive's when required shall have BMS communication protocols to include Modbus RTU; Johnson Controls N2, and BACnet MS/TP.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be the responsibility of the Contractor. The Contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual, NEC and local codes. The Contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

B. Power wiring shall be completed by the electrical contractor in accordance with NEC Section 430.122 wiring requirements based on the VFD input current.

C. For all VFD applications, the input and output cables to/from the VFD shall be run in separate metal conduits, or using shielded VFD cable. For multi-motor applications each VFD output shall have its own metal conduit or shielded VFD cable to/from the motor. Each motor shall have its own properly rated motor overload protection.

D. Input and output power wiring shall be segregated from low voltage analog, communication, control, and be UL listed for the appropriate voltage and be shielded cable. Installation shall be per the NEC and shall include adequate clearance between types.

3.2 START-UP

A. Factory start-up shall be provided for each VFD by a factory authorized service technician.

3.3 PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at the installation location. A toll free 24 hour/365 day technical support phone line connected to factory support personnel located in the United States shall be available.

B. Training by a factory authorized technician shall include installation, programming, and operation instruction for each VFD.

C. The VFD supplier shall stock standard VFD’s and standard repair parts such that the Owner does not need to stock them.

END OF SECTION

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) 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
Heat Pump Loop Piping
Condensate Drain Piping
Pipe and Pipe Fitting Systems
Miscellaneous Piping

Hydronic Accessories
Air Separators
Expansion Tanks
Chemical Feeders
Miscellaneous Valves
Pump Suction Diffusers
Flexible Connections

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 guide. Include this data and product data in the operation and maintenance manual, in accordance with all associated requirements.

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. Steel Pipes and Pipe Fittings
   1. When Schedule 40 black steel pipe is specified in sizes 12” and larger the wall thickness shall be .375” to match the associated fitting thickness.
   2. Black Steel Pipe: ASTM A53, A106, or A120; except comply with ASTM A53 or A106 where close coiling or bending is required.
   3. Galvanized Steel Pipe: ASTM A53 or A120; except comply with ASTM A53 where close coiling or bending is required.
   4. Malleable Iron Threaded Fittings: ANSI B16.3; plain or galvanized to suit piping. For use above grade only, except where indicated otherwise.
   5. Malleable Iron Threaded Unions: ANSI B16.39; selected by the Contractor for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze, or brass), plain or galvanized as indicated.
   6. Forged Steel Socket Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.
   7. Wrought Steel Butt-Welding Fittings: ANSI B16.9, except ANSI B16.28 for short radius elbows and returns; rated to match connected pipe.

8. Pipe Nipples: Fabricated from same pipe as used for connected pipe, except do not use less than Schedule 80 pipe where the length remaining unthreaded is less than 1-1/2 inches and where the pipe size is less than 1-1/2 inches. Do not thread nipples full length (no close nipples are allowed).

C. 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.

D. 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.

E. 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. Heat Pump Loop Piping Indoors: ASTM A53 or ASTM A120 Schedule 40 black steel with standard weight, long radius, butt-welding fittings and 150 lb forged steel, weld-neck type flanges. Connections to threaded equipment, valves, etc. shall be made with 150 lb cast iron, threaded fittings. Piping 2 inches and smaller shall have 150 lb screwed, cast iron fittings. Slip-on flanges will be permitted where space is limited with prior written approval by the Architect/Engineer. All slip-on flanges shall be back-welded.
   1. At the Contractor's option heat pump loop piping 2" and under may be copper tube; ASTM B88 Type L, hard drawn temper, with wrought copper fittings and brazed joints.

B. Relief Valve Discharge Piping: Same as specified for cooling coil condensate drain piping, except that plugged fittings will not be required.

C. Water and Drain Connections to Equipment or to Stubs by Plumbing Contractor: Schedule 40 steel pipe with 150 lb malleable iron fittings. Provide dielectric unions if connections are to copper lines. Pipe and fittings shall be black or galvanized steel as required to match piping to which connected.

D. Air Vent Discharge Piping: Type L hard copper tubing with wrought copper solder joint fittings and 95 percent tin, 5 percent antimony solder.

2.5 HYDRONIC ACCESSORIES

A. Air and Dirt Separators

1. In-Line Air and Dirt Separators: Provide in-line air and dirt separators of size and capacity as indicated on the drawings. Tank shall be constructed of carbon steel and pressure rated for 125 psi at 375°F in compliance with ASME Boiler and Pressure Vessel Code Section VIII. Air and dirt separators shall include an integral magnetic dirt filter.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering air and dirt separators which may be incorporated in the work include the following, or approved equal:

   Taco Model 4900-ADM-125
   Thrush
   Spirotherm

B. Expansion Tanks

1. Replaceable bladder type. Shell and heads shall be of carbon steel welded construction in accordance with ASME Section VIII for 125 psi working pressure. Provide full volume flexible butyl rubber bladder, bottom system connection, air charging fitting, drain connection, lifting eye, and base ring for vertical mounting. Factory pre-charge as indicated on drawings.
2. Install a ball valve with lockshield at all expansion tanks. Ball valves with lockshield shall be Crane Model D171, or approved equal.
3. 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
   Elbi

C. Chemical Feeders (See Specification Section 232500 - Chemical Treatment).

D. Propylene Glycol Feed Systems (See Specification Section 232500 - Chemical Treatment).

E. Basic Hydronic Valves

1. Provide valves complying with Section 230500 (Basic Materials and Methods for HVAC) and in accordance with the following listing.

a.	Shutoff Valves:	
	3 inch and smaller:	Ball Valves
	4 inch and larger:	Butterfly Valves
b.	Sectional Valves:	
	3 inch and smaller:	Ball Valves
	4 inch and larger:	Butterfly Valves
c.	Drain Valves:	
	3 inch and smaller:	Ball Valves
	4 inch and larger:	Butterfly Valves
d.	Check Valves (All Sizes):	Non-Slam Swing Check Valves
e.	Balance Valves (All Sizes):	Fixed Port Venturi Valves
f.	Air Vent Valves:	Manual or Automatic with Ball Type Isolation Valve

F. Pressure Compensating Flow Limiting Valves
   1. Provide pressure compensating flow limiting valves where shown on the drawings. Valve shall provide shutoff, measurement, and flow limiting functions.
   2. Valves 2 inch and smaller shall be all brass construction with one male thread end with a brass ball valve, and one union end. Pro Hydronic Specialties Model AFLB, or approved equal.
   3. Valves 3 inch and larger shall be ductile iron construction with flanged ends, and a ductile iron butterfly valve with aluminum bronze disc and stainless steel stem. Pro Hydronic Specialties Model AFLWF, or approved equal.
   4. Valves shall have a removable stainless steel flow cartridge and a stainless steel spring.
   5. Valves shall be rated for a minimum of 300 psi at 250°F, shall have a flow control accuracy of 5%, and shall have a control range of between 2 and 60 psi.
   6. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following, or approved equal:
      Pro Hydronic Specialties
      IMI Flow Design
      Bell and Gossett

G. Pump Suction Diffusers
   1. Provide suction diffusers of size and capacity required for pump connections.
   2. Construction: Cast iron body with removable strainer and fine mesh flow straightener.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pump suction diffusers which may be incorporated in the work include the following, or approved equal:
      Taco
      Bell and Gossett
      Armstrong

H. Flexible Connections (Pumps)
   1. Provide flexible connections between 9 & 14 inches long where indicated on the drawings and/or as required to accommodate movement or vibration of the piping system.
   2. Flexible connections shall be all stainless steel with carbon steel flanges. Flexible connections shall be rated for no less than 160 psi working pressure at 70°F. Flexible connections shall be Twin City Hose Model TCHS, or approved equal.

I. Flexible Connections (Air Handling Units, Chillers, Cooling Towers, Fluid Coolers, etc.)
   1. Provide flexible connections between 9 & 14 inches long where indicated on the drawings and/or as required to accommodate movement or vibration of the piping system.
   2. Flexible connections shall be all stainless steel with carbon steel flanges. Flexible connections shall be rated for no less than 160 psi working pressure at 70°F. Flexible connections shall be Twin City Hose Model TCHS, or approved equal.

J. Flexible Connections (Rooftop Units, Fan Coil Units, Heat Pumps, Motorized Equipment)
   1. Provide 18 inch long flexible connections where indicated on the drawings and/or as required to accommodate movement or vibration of the piping system.
   2. Flexible connections shall be all stainless steel with carbon steel ends. Flexible connections shall be rated for no less than 370 psi working pressure at 70°F. Flexible connections shall be Twin City Hose Model HPH, or approved equal.

K. Wye Strainers

1. Provide wye strainers of size and capacity as indicated on the drawings. Strainers shall be constructed of epoxy painted cast iron or ductile iron, shall be ANSI Class 125, rated for 200 psi at 150°F, with pressure tappings to allow for assessment of strainer pressure drop. Wye strainers shall be constructed of stainless steel with .015" openings (40 mesh).
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering wye strainers which may be incorporated in the work include the following, or approved equal:

   Titan Flow Control Model YS-58-CI
   Zurn Wilkins Model FSC

L. Basket Strainers

1. Provide basket strainers of size and capacity as indicated on the drawings. Strainers shall be Thompson Strainer Model LLS with Model PDA2 pressure differential alarm package, constructed of Type 304 stainless steel, and rated for 150 psi at 150°F. Strainer screen shall be constructed of heavy duty stainless steel (.007 inch wire diameter) with .0039" openings (150 mesh).
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering basket strainers which may be incorporated in the work include the following, or approved equal:

   Miller Leaman Thompson Strainer Model MLS

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which hydronic piping systems and specialties are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 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. Comply with ANSI B31 Code for Pressure Piping.

E. 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.

F. Hold piping close to walls, overhead construction, columns, and other structural and permanent enclosure elements of the building; limit clearance to ½ inch where furring is shown for enclosure or concealment of piping; locate insulated piping for one inch clearance outside insulation.

G. 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.

H. 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.

I. 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.

J. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.

K. Install exposed polished or enameled connections from fixtures or equipment with special care, showing no tool marks or threads at fittings.

L. Cap or plug openings in pipe and fittings immediately to exclude all dirt until fixtures are installed or final connections made.

M. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used.

N. Condensate Drain Piping: Run piping with downward pitch as indicated, without pockets.

O. 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.

P. 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.

Q. 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.

R. Install piping subject to expansion or contraction in a manner permitting strains to be evenly distributed and alleviated by expansion loops installed as required.

S. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeve.

3.3 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.

3.4 INSTALLATION OF VALVES

A. All valves shall be installed in locations that are reasonably accessible without the use of a ladder unless otherwise indicated on the drawings (such as in the case of valves equipped with chain operators).

B. Drain Valves: Install at each mechanical equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop, and elsewhere as indicated or required to completely drain each piping system

C. Check Valves: Install on the discharge side of each pump and elsewhere as indicated.

3.5 INSTALLATION OF HYDRONIC ACCESSORIES

A. Balance Valves: Install balance valves on each hydronic terminal and elsewhere as indicated. After hydronic system balancing has been completed, mark each balance valve with stripe of yellow lacquer across body and stop plate to permanently mark final balanced position.

B. Manual Vent Valves: Install manual 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.

C. Automatic Vent Valves: Install automatic 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.

D. In-Line Air Separators:

1. Route piping to expansion tank with ¼ inch per foot upward slope towards tank.
2. Install drain valve on all air separators.

E. Bladder Type Expansion Tanks: Install diaphragm type expansion tanks on floor as indicated, in accordance with manufacturer's instructions. Vent and purge air from hydronic system and charge tank with proper air charge as indicated on the drawings. Coordinate the charge pressure with the fill pressure to ensure flow to highest coil in system.

F. Chemical Feeders: Install in upright position with top of funnel not more than 48 inches above finished floor. Install balance valve in pump discharge line to allow for adjustment of the desired flow out of the chemical feeder. Pipe drain to nearest plumbing drain or as indicated.

G. Pressure Reducing Valves: Install for each heat exchanger as indicated and in accordance with manufacturer's installation instructions.

3.6 CLEANING OF HYDRONIC PIPING SYSTEMS AND EQUIPMENT

A. Preparation:

1. System shall be operational prior to cleaning.
2. Make temporary piping connections and provide a temporary bypass filter to properly accomplish cleaning the entire system. 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.
3. Place all manual, pressure regulating and control valves serving the system in open position during cleaning so that circulation through the system is obtained during cleaning.
4. Verify that electric power is available and of the correct characteristics for any cleaning equipment.

B. Cleaning Sequence:

1. Any and all cleaning and flushing procedures outlined in this section and in Section 232500 (Chemical Treatment) shall occur before any piping is connected to the heat pump equipment or any other coils (*No Exceptions*). No flushing will be permitted after any equipment and/or coils are connected to the system.
2. Projects with distribution to/from other buildings or to a ground source bore field: Provide a temporary basket strainer with .125” perforations to protect the piping inside the building from the ground loop piping outside the building. The ground loop piping shall be flushed and cleaned prior to connecting to the piping inside the building.
3. If any equipment and/or coils are connected to the system during cleaning and flushing procedures, the Owner has the right to have each affected water coil replaced with a new factory coil at no cost to the Owner.

4. Initial Flush (all hydronic systems):
   a. 1st filling: Completely fill the system with fresh water and circulate at 6 feet per second for 4 hour minimum.
   b. Initial flushing 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.
5. Cleaning Flush:
   1. Use concentrated chemical cleaner in piping system. Cleaner shall be a solution consisting of 2 lbs tri-sodium phosphate for each 1000 lbs of water contained in the system.
   2. Circulate the solution at 6 feet per second for the recommended time period corresponding to the cleaning fluid temperature.
      1) Partially close and reopen all manual valves twice during the flushing duration.
         a. Test solution for proper concentration and document results.
         b. Completely drain the entire system.
      2) 3rd filling: Refill the system with fresh water. Then, with the circulation pump running, open drain(s) as far downstream from the fill point as is possible. Ensure makeup is sufficient to keep up with the drain to maintain a full system.
      3) Partially close and reopen all manual valves twice during the flushing duration.
      4) Blowdown all strainers, dead legs and low points in the system.
      5) Continue to flush the system in this manner until the drain water is of the same clarity as the makeup water and testing reveals no further traces of cleaning solution (flush for minimum of 1 hour). Document the results.
      6) Following the fresh water flush, drain the entire system.
      7) Clean all strainers, and then fill and treat the entire system.

3.7 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

Heat Pump Loop Water Piping

Test Pressure	Test Medium
150 psi at rough-in	Water
100 psi after equipment connection	Water

3.8 EQUIPMENT CONNECTIONS

A. Connect hydronic piping system to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union on supply and return; drain valve on drain connection.

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 equipment and trim installed as part of this work. Leave systems and equipment in 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 23 21 10 - 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) 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. Peroxidically cured EPDM elastomeric sealing element rated to 300 psi with a temperature range of 0°F thru 250°F. Sealing element shall be uniform in size/thickness and shall be free from manufactured deformities or indentations.
   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, or approved equal.

B. Approved Tool Manufacturers for Installation of Press-Connect Fittings
   1. Viega, Milwaukee, and/or Rigid.

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.

END OF SECTION

SECTION 23 21 80 - SNOW AND ICE MELT PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Snow and ice melting systems (SIM), where shown on the drawings and equipment schedules, shall be hydronic, and shall include the following:
   1. Crosslinked polyethylene (PEX) piping.
   2. Distribution manifold(s) with balancing and flow control valves where required.
   3. Pipe-to-manifold compression nut fittings.
   4. Pipe fasteners as approved by the manufacturer of the PEX piping.
   5. Controls.
   6. Field supervision and engineering as required for the complete and proper function of the entire system.

1.2 STANDARDS AND REFERENCES

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

B. American Society for Testing and Materials
   1. ASTM E84: Standard Test Method for the Surface Burning Characteristics of Building Materials.
   2. ASTM F876: Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
   3. ASTM F877: Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems.
   4. ASSE 1061: Potable Water Brass Push-Fit Fittings.
   5. ASTM F1807: Metal Insert Fitting Assembled with Copper Crimp Rings.
   6. ASTM F1960: Cold Expansion Fittings, Metal and Polymer, with PEX Reinforcing Rings.
   7. ASTM F2080: Cold Expansion Fitting with Metal Compression Sleeve.
   8. ASTM F2098: Stainless Steel Clamps with ASTM F1807 Brass Insert Fittings.
   9. ASTM F2159: Plastic Insert Fittings Assembled with Copper Crimp Rings.
   10. ASTM F3347: Metal Insert Fitting with Stainless Steel Press Sleeve.
   11. ASTM F3348: Polymer Insert Fitting with Stainless Steel Press Sleeve.

C. Canadian Standards Association
   1. CSA B137.5: Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
   2. CSA B214: Installation Code for Hydronic Heating Systems.

D. International Organization for Standardization
   1. ISO 9001: Quality Management Systems - Requirements.

E. Underwriters Laboratories of Canada
   1. CAN/ULC S102.2: Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials.
   2. CAN/ULC S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials.

F. Plastic Pipe Institute
   1. PPI TR-3: Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.

1.3 DEFINITIONS

A. Crosslinked polyethylene, commonly abbreviated PEX, is made from high density polyethylene (HDPE). Crosslinking is accomplished during manufacturing. Crosslinking enhances the physical & mechanical properties of the polymer. The high temperature properties are improved. Chemical resistance is enhanced by resisting dissolution. Low temperature properties are also improved; its impact and tensile strength, scratch resistance, and resistance to brittle fracture are enhanced.

B. The PEX piping shall be crosslinked polyethylene tubing that is outside-diameter-controlled, made in standard thermoplastic tubing dimension ratios, and pressure rated for water at three temperatures. This specification covers one PEX tubing material in one standard dimension ratio, having pressure ratings for water at various temperatures. The pressure ratings decrease as the temperature increases. PEX tubing shall be made from polyethylene compounds which have been crosslinked by peroxides, azo or silane compounds in extrusion, by electron beam after extrusion, or by other means such that the tubing meets the specified performance requirements. The following tests shall be performed: dimension and tolerance testing; density testing; sustained pressure testing; burst pressure testing; environmental stress cracking testing; degree of crosslinking testing; stabilizer functionality testing; and oxidative stability testing in potable chlorinated water applications.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's Technical Manual, submittal forms, catalog cuts, brochures, specifications, and installation instructions. Submit data in sufficient detail to indicate compliance with the contract documents.
   1. Submit manufacturer's instructions for installation.
   2. Submit data for equipment, fittings, fasteners, and associated items necessary for the installation of the piping and manifolds.

B. Submit computer generated SIM system design indicating heat flux, pipe sizing, spacing, flow rates and temperatures. SIM design calculations shall be performed on pipe manufacturer’s software.

C. Drawings: Provide plans drawn to scale for all installation areas.
   1. Indicate dimensions, descriptions of materials, general construction, component connections, anchorage methods, and installation procedures.
   2. Indicate design, schematic layout of system, including equipment, critical dimensions, and piping/slab penetration details as well as details for protecting exposed PEX piping.

D. Certification
   1. Submit independent certification results for the piping systems from an accredited independent testing laboratory.
   2. The design shall be approved by a professional appropriately licensed in the jurisdiction where the installation will take place, as being complete and accurate.
   3. Fittings shall be third party certified to applicable referenced standards as part of the manufacturer’s PEX piping system, with independent listings from NSF, CSA and ICC, as applicable.

E. Maintenance Instructions: Submit instructions for finished product maintenance.

1.5 QUALITY ASSURANCE

A. System manufacturer must be a company specializing in the work of this section with a minimum of 5 years documented experience.

B. Pipe shall be manufactured in a facility where the quality management system is ISO 9001 certified.

C. Crosslinked polyethylene (PEX) pipe shall conform and be certified to ASTM F876, F877, and CSA B137.5, and shall have the PPI TR-3 listing. Pipes with an oxygen diffusion barrier shall conform to the requirements for oxygen permeability (DIN 4726).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and equipment in shipping containers with labeling in place. Pipe shall be kept in original shipping boxes until required for installation.

B. Store piping and equipment in a safe, dry, enclosed, under cover, and well ventilated area.
   1. Do not expose pipe to ultraviolet light beyond the exposure limits recommended by manufacturer.
   2. Protect piping and manifolds from entry of contaminating materials. Install suitable plugs in open pipe ends until installation.
   3. Where possible, connect pipes to assembled manifolds to eliminate the possibility of contaminants and cross connections.
   4. Piping shall not be dragged across the ground or other surfaces, and shall be stored on a flat surface with no sharp edges.

C. Protect materials from damage by other trades.

D. Pipe shall be protected from oil, grease, paint, direct sunlight, and other elements as recommended by manufacturer.

1.7 WARRANTY

A. Provide manufacturer's standard written warranty.
   1. To repairing or replacing the defective product in question or providing a refund of the defective product’s purchase price.
   2. The radiant heating pipe manufacturer shall warrant the crosslinked polyethylene piping to be free from defects in material and workmanship for a period of 25 years.
   3. Cold expansion compression sleeve fittings shall be warranted to be free from defects in material and workmanship for a period of 25 years.
   4. All manifolds, distribution headers, thermostats, and actuators shall be warranted to be free from defects in material and workmanship for a period of 2 years starting at completion of successful pressurized water tests immediately following system installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   Rehau
   Uponor
   Viega

2.2 PIPING

A. Snow and ice melt system pipe shall be high density crosslinked polyethylene (PEX). Pipe shall conform to ASTM F876, ASTM F877, and CSA B137.5.

B. Pipe shall be rated for continuous operation of 100 psi pressure at 180°F temperature and 80 psi pressure at 200°F.

C. When required, pipe shall have a co-extruded oxygen diffusion barrier capable of limiting oxygen diffusion through the pipe to less than 0.32 mg/m^2/day at 104°F water temperature in accordance with DIN 4726.

D. Bend Radius: The minimum bend radius for cold bending of the pipe shall be not less than 5 times the outside diameter. Bends with a radius less than 5 times the outside diameter shall require the use of a bending template as supplied by the pipe manufacturer, and/or hot air.

E. Pipe shall have a flame spread index and smoke developed index complying with ASTM E84.

F. Fittings shall be third party certified to the standards listed in Section 1.2 (Standards and References), as applicable.

G. Compression nut manifold fittings shall be manufactured of brass with a barbed insert and a reusable split compression ring.

H. Compression sleeve fittings shall be manufactured of brass and shall be approved by the piping manufacturer to be part of a proven cataloged system.

I. Fittings embedded within the thermal mass or encased behind walls or ceilings shall be protected from external environmental conditions.

2.3 MANIFOLDS

A. Material: Distribution manifolds shall be manufactured of brass or copper and be supplied by the piping manufacturer as a proven cataloged part of the manufacturer's system.

B. Brass manifolds shall be produced from extruded brass round pipe with tapped holes for connections, and be pre-assembled by the manufacturer. 100% of manifolds used shall have been air tested by the manufacturer with no indication of leaks.

C. Balancing Manifolds

1. Where required by design, brass balancing manifolds shall be equipped with integral visual flow gauges, circuit balancing and flow control valves, isolation valves with integral thermometer housings, and air vent/fill ports.
2. Each circuit valve shall be supplied with a manual actuating handle for filling/purging operation.

D. Copper Manifolds

1. Copper manifolds shall be manufactured from Type L copper.
2. Copper and/or brass outlets shall be high temperature brazed (lead free) into headers.

2.4 INSULATION

A. Snow and ice melt piping shall be installed with a minimum of R-10 insulation directly beneath the piping, and a 15 mil vapor barrier directly below the insulation.

B. Insulation shall extend a minimum of 12 inches on all sides of each pipe.

C. Insulation for non-traffic rated areas shall be 2” thick Owens Corning Foamular NGX-400, or approved equal, with a compressive strength of 40 psi in accordance with ASTM D2863. Insulation shall have a minimum thermal resistance of R-5.0 per inch at 75°F.

D. Insulation for traffic rated areas shall be 2” thick Owens Corning Foamular NGX-1000, or approved equal, with a compressive strength of 100 psi in accordance with ASTM D2863. Insulation shall have a minimum thermal resistance of R-5.0 per inch at 75°F.

2.5 CONTROLS

A. Automatic SIM Detector and Melting Controls
   1. SIM control shall use low voltage devices to monitor outdoor ambient, slab, fluid supply and/or return temperatures, as well as an automatic snow and ice detector to detect moisture in the SIM zone.
   2. The SIM controller shall have a BACnet connection interface capability.
   3. SIM control shall be capable of maintaining a set temperature in a SIM slab or thermal mass, with adjustable settings for idle and melting mode.
   4. Connection to output devices shall be per the manufacturer’s installation instructions for the SIM control system, as part of a proven cataloged system.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. As a minimum, installation shall be performed by qualified laborers trained by the manufacturer in the procedures of PEX SIM systems and appropriately licensed for the local jurisdiction.

B. Examine areas and conditions under which the work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until all unsatisfactory conditions are corrected.

C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Coordinate with related trades and manufacturer’s recommendations with regard to installation in conjunction with the following:
   1. Reinforcing wire mesh or rebar.
   2. Precast or existing concrete subgrade.
   3. Asphalt or other hot mix.
   4. Patio pavers.
   5. Preparation of space for manifold installation.
   6. Mounting outdoors or in an unheated indoor environment.

3.3 INSTALLATION

A. Install in accordance with manufacturer's published installation manual, published guidelines, and final drawings.

B. Mount manifolds in the locations indicated. Manifolds shall be mounted as level as possible.

C. Route piping in an orderly manner, according to layout and spacing shown in final drawings.

D. At connections and fittings, use a plastic pipe cutter to ensure square and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants. Where fittings are installed within the thermal mass, they shall be wrapped in chloride-free tape or sealed within a heat shrink material approved by the manufacturer.

E. Pipe shall be dispensed using a suitable uncoiling device. Remove twists prior to securing pipe. Pipe shall lie flat on an even plane. Finished grade of a thermal mass shall be a minimum of 3/4 inches above the top of PEX heating pipes. Fasten piping at no more than 3 foot intervals, being careful not to twist the pipe. In thin concrete slabs, secure piping every 2 feet. Use only fasteners supplied or approved by the manufacturer of the PEX pipe.

F. Piping that shall pass through expansion joints shall be covered in protective polyethylene convoluted sleeving (flexible conduit) extending 15 inches on each side of the joint. Sleeving shall be secured on pipe to prevent movement during installation of thermal mass.

G. Where piping exits the thermal mass, a protective conduit shall be placed around the pipe, with the conduit extending a minimum of 6 inches into the floor and exiting by a minimum of 6 inches. For penetrations at manifolds, use rigid PVC bend guides secured in place to prevent movement.

H. At the time of installation of each circuit of pipe, connect the pipe to the correct manifold outlet and record pipe length for balancing. If manifold is not installed, cap the end of the pipe and label the pipe's circuit numbers along with S for supply and R for return. Connect pipes to manifold as soon as possible and record circuit lengths. Circuits shall be labeled to indicate circuit length and serviced area.

I. The installer shall confirm minimum and maximum exposure temperatures for the substrate material (thermal mass) and shall ensure proper SIM operating temperatures.

3.4 FIELD QUALITY CONTROL

A. Filling, Testing & Balancing: Tests of hydronic heating systems shall comply with authorities having jurisdiction, and, where required, shall be witnessed by the building official.

B. Pressure gauges used shall show pressure increments of 1 psi and shall be located at or near the lowest points in the distribution system.

C. Air Test
   1. Charge the completed, yet unconcealed pipes with air at a minimum of 40 psi.
   2. Do not exceed 150 psi.
   3. Use liquid gas detector or soap solution to check for leakage at manifold connections.

D. Water Test
   1. Purge air from pipes.
   2. Charge the completed, yet unconcealed pipes with water.
   3. Take necessary precautions to prevent water from freezing.
   4. Check the system for leakage, especially at pipe joints.

E. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psi for 30 minutes.
   1. As the piping expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.
   2. At the end of the 30 minute preliminary test, pressure shall not fall by more than 8 psi from the maximum, and there shall be no leakage.

F. After successfully performing the preliminary test, perform the main pressure test immediately.
   1. The main pressure test shall last 2 hours.
   2. The test pressure shall be restored and shall not fall more than 3 psi after 2 hours.
   3. No leakage shall be detected.

G. Pressure shall be maintained and monitored during installation of the thermal mass.
   1. If any leak is detected during installation of thermal mass, leak shall be found immediately and the area cleared for repair using manufacturer’s approved repair coupling.
   2. Retest before covering repair.

H. Complete inspections and furnish test reports supplied by the manufacturer of the system.

I. All low voltage equipment shall be tested. The following items shall be checked at a minimum:
   1. Inputs
   2. Outputs
   3. Sequence of Operation

3.5 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.

3.6 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

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 23 22 00 - HYDRONIC 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) are hereby made a part of this section.

1.2 WORK INCLUDED

A. This section includes various pump types and pump accessories.

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, or approved equal:

Taco
Bell and Gossett
Grundfos

C. UL Compliance: Provide electric components for pumps which have been listed by Underwriters Laboratories.

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 each type of pump, control, and accessory, including trouble-shooting maintenance guide. Include this data and product data in the operation and maintenance manual, in accordance with all associated requirements.

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 HYDRONIC PUMPS

A. General: Provide factory tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size, and capacity of each pump as listed in pump schedule. Provide pumps of same type by same manufacturer.

B. Motors (Open Drip Proof): Provide motors, which are non-overloading at any point on the pump curve, with built in overload protection on single phase motors. The scheduled motor horsepowers are evaluated minimums and larger motors shall be submitted and furnished if necessary to meet the non-overloading requirement. Pump motors shall be premium efficiency type as defined in NEMA MG1.

C. Vertical Split-Coupled Inline Pumps (VFD Compatible)

1. Pump capacities and characteristics shall be as identified on the plans and in the pump schedules. Pumps shall be Taco Model KS, or approved equal. Pumps shall be single stage end suction rear pull out design. The seal shall be serviceable without disturbing the piping connections.
2. Pump casing shall be constructed of ASTM A48 Class 30 cast iron. Pump casing/volute shall be rated for 250 psi working pressure. The pump flanges shall be matched to suit the working pressure of the associated piping components with either ANSI Class 125 flanges or ANSI Class 250 flanges.
3. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The pump casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line. The pump cover shall be drilled and tapped to accommodate a seal flush line which can be connected to the corresponding tapping on the discharge connection, or to an external source to facilitate cooling and flushing of the seal faces.
4. All casings shall be flanged. Threaded casings are not allowed unless extra unions and fittings are provided with the pump to allow servicing.
5. The pump shall have a factory installed vent/flush line to ensure removal of trapped air from the casing and provide mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.
6. The impeller shall be ASTM B584-836/875 bronze and shall be hydraulically balanced. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. The impeller shall be cast by the hydraulically efficient lost foam technique to ensure repeatability of high quality.
7. The pump shall be manufactured with an ASTM A582 Type 416T or ASTM A582 Type 410T stainless steel shaft.
8. The pump shall be fitted with a single mechanical seal, with EPT elastomers and carbon/ceramic faces, rated up to 250°F. The seal must be capable of being flushed externally via a tapping in the pump cover adjacent to the seal cavity.
9. The pump shall be coupled via a high tensile aluminum split style coupling. The design must permit easy replacement of the mechanical shaft seal without removal of the motor. The motor mount must be designed to accept several different motor frame standards.
10. In order to both simplify and reduce the total cost of ownership, the manufacturer shall standardize on no more than three sizes of mechanical seals throughout the entire range of the family of pumps. The manufacturer shall not use multiple part numbers for the same part.

D. Close-Coupled In-Line Pumps (VFD Compatible)

1. Pump capacities and characteristics shall be as identified on the plans and in the pump schedule(s). Pumps shall be Taco Model KV, or approved equal. Pumps shall be centrifugal, overhung-impeller, close-coupled, in-line type, designed for installation with the pump and motor shafts mounted horizontally or vertically.
2. Pump casing shall be radially split, cast iron, with threaded gauge tappings at inlet and outlet, replaceable bronze wear rings, and companion-flange connections.
3. Pump impeller shall be Type 304 stainless steel or cast bronze**,** statically and dynamically balanced, keyed to shaft, and secured with a stainless steel locking cap screw. For pumps that are not variable frequency drive controlled, trim the impeller to match the specified performance.
4. Pump shaft sleeve shall be bronze.
5. Pump seal shall be a mechanical seal consisting of ceramic/EPT or silicon carbide/EPT Include water slinger on the shaft between the motor and the seal.
6. Seal Flushing: Flush, cool, and lubricate pump seal by directing pump discharge water to flow over the seal.
7. All pump suctions shall be fitted with a multi-function inlet suction diffuser fitting. The suction diffuser body and cover plate shall be ductile iron and be rated for 250 psi. The diffuser flanges shall be matched to suit the working pressure of the piping components; with either ANSI Class 125 flanges or ANSI Class 250 flanges.
8. The pump suction diffuser shall include the following components: full length stainless steel straightening vanes, permanent stainless steel strainer, disposable 16 mesh bronze startup strainer, blow-down ports, and metering ports. For pumps where a suction diffuser is not installed there shall be five pipe diameters of straight undisturbed flow entering the pump suction. Suction diffusers shall be a Taco Model SD, or approved equal.
9. Change start-up strainers to permanent strainers upon acceptance by the Owner and Engineer. Provide a blow-down valve on each strainer and terminate with hose thread fitting or extend blow-down piping to the nearest floor sink.
10. Motor shall be totally enclosed, fan cooled or open, drip proof as scheduled, and shall be NEMA premium efficiency as defined in NEMA MG1.

E. Close-Coupled In-Line Pumps (with EC Motor)

1. Pump capacities and characteristics shall be as identified on the plans and in the pump schedule(s). Pumps shall be Taco Viridian Series, Taco 1900E Series, Grundfos Model Magna3, or approved equal. Pumps shall be variable speed, EC Motor, in-line type, designed for installation with the pump mounted horizontally or vertically.
2. Pump casing shall be cast or ductile iron (stainless steel for potable water applications) with threaded gauge tappings at inlet and outlet.
3. Pump impeller shall be stainless steel or composite**,** statically and dynamically balanced, with a stainless steel shaft.
4. Pump shall include a digital display, 0-10 volt dc control input for the EC motor, and a status indicating light.

F. Base-Mounted End-Suction Centrifugal Pumps

1. Pumps shall be of type capacity, and with accessories as scheduled on the drawings.
2. Provide factory-assembled and tested, centrifugal, API 610-OH1 type, overhung impeller, separately coupled, end suction pumps with flexible shaft coupling as defined in ANSI HI-14.1, HI-14.2, and HI-14.3; designed for base mounting, with pump and motor shafts horizontal.
3. Pump Construction
   a. Casing: Radially split, cast iron, with flanged connections, threaded gauge tappings at inlet and outlet, drain plug at bottom, and air vent at top of volute. Pump volute shall be foot mounted.

b. Impeller: ASTM B584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim pump impeller to match the scheduled performance.
c. Pump Shaft Sleeve: Type 303 stainless steel.
d. Pump Shaft: Type 416 stainless steel.
e. Seal (Mechanical Type): Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and EPDM bellows and gasket.
f. Pump Bearings: Grease-lubricated ball bearings in cast iron housing with grease fittings for lubrication in the field.

4. Shaft Coupling: Molded-rubber insert capable of absorbing vibration. Spacer couplings shall be drop-out type, with EPDM coupling sleeve.
5. Coupling Guard: Coupling guards shall comply with ANSI B15.1 and OSHA 1910.219. Guards shall be constructed of steel, shall be removable, and shall be attached to the mounting frame.
6. Mounting Frame: Welded steel frame and cross members, factory-fabricated from ASTM A36/A36M channels and angles. Fabricate the mounting frame to mount the pump casing, coupling guard, and motor.
7. Controllers, electrical devices, and wiring shall comply with the requirements for electrical devices and connections specified in Division 26.

G. Pump Accessories and Installation
1. All pumps shall be fitted with suction and discharge isolation valves, flexible connections, and a check valve to prevent reverse flow.
2. Check valves 2-1/2” and larger shall be iron body, silent, vertical spring type, Nibco Model F-910, Titan Model CV-50-DI, or approved equal. Check valves 2” and smaller shall be bronze or brass body, silent, vertical spring type, Nibco Model T-480, Titan Model CV-20-BR, or approved equal.
3. All pumps shall be fitted with one 4-1/2” dial pressure gauge piped to the inlet and outlet pump flanges. The gauge shall be isolated from each flange via 1/4” ball valves. The gauge is intended to be used to read the differential across the pump.
4. The Contractor shall install pumps in accordance with the pump manufacturer’s written instructions. The Contractor shall level and align each pump.
5. Pumps shall not be run dry to check rotation.
6. Pipe connections to pumps shall be made in a manner so as not to exert any stress on the pump housing(s). If necessary to meet this requirement, provide additional pipe supports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PUMPS

A. Install pumps where indicated, in accordance with manufacturer's published instructions, complying with recognized industry practices to ensure that pumps comply with requirements and serve intended purposes.

B. Provide access space around pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Install base-mounted pumps on minimum of 4 inch high concrete pad, with anchor bolts poured in place. Set and level pump; grout under pump base with non-shrink grout. Provide drain line to nearest floor drain or floor sink.

D. Install in-line pumps with support from overhead structure on each side of pump, or as indicated on the drawings.

E. Piping shall be supported from the building structure so as to prevent any strain on the pump casings. A final check for perfect alignment of the piping connections shall be made after pump has been secured to its base. Provide valves, accessories, gauges, supports, and flexible connections, as indicated on the drawings and in these specifications.

F. Install electrical devices furnished by the pump manufacturer but not specified to be factory mounted. Coordinate the pump manufacturer's wiring diagram submittal with the electrical subcontractor.

G. Verify that the electrical wiring installation is in accordance with the pump manufacturer's submittal and with the installation requirements listed in Division 26. Do not proceed with equipment startup until the wiring installation is complete and correct.

H. Check alignment, and where necessary, realign shafts of motors and pumps within the recommended tolerances provided by the manufacturer.

I. Lubricate pumps before startup. Startup procedures shall be conducted in accordance with the manufacturer's written instructions.

J. Pumps shall not be connected to piping before piping is thoroughly flushed and cleaned of all dirt and grit. After piping connections have been made, systems shall be filled before starting pumps. Pumps shall not be run dry under any circumstances.

K. For base-mounted, end-suction pumps, comply with the requirements in ANSI HI standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt the motor to the base frame. Do not use grout between motor feet and base frame.

L. For base-mounted, end-suction pumps, after alignment is correct, tighten foundation bolts evenly, but not too firmly. Completely fill the baseplate with non-shrink, non-metallic grout while metal blocks and shims or wedges are in place. After the grout has cured, fully tighten the foundation bolts.

M. Training: Provide a minimum of 4 hours of training and orientation of the Owner’s operating staff in proper care and operation of equipment, systems, and controls.

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 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 25 00 - CHEMICAL TREATMENT

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) are hereby made a part of this section.

1.2 GENERAL

A. All water treatment equipment, chemicals, test equipment, start-up service, and warranty period service shall be provided by one of the following water treatment specialists, or approved equal:

San Joaquin Chemicals
Chemtex Corporation
Garratt Callahan
Global Water Technology

B. The Contractor as referred to in this section of the specifications is generally intended to mean the mechanical contractor; however, work identified herein to be completed by the mechanical contractor may be assigned to and/or completed by the water treatment specialist.

1.3 INITIAL SYSTEM CLEANING

A. The entire initial system cleaning process (including removal, cleaning, and replacement of strainers) shall be witnessed by the Owner’s designated representative. Any portion of the process that is not witnessed by the Owner’s designated representative will need to be repeated. The water treatment specialist shall be on site to supervise and monitor the initial system cleaning procedures for each system. Also see Specification Section 232100-3.7 (Cleaning of Hydronic Piping Systems and Equipment).

B. The Contractor shall coordinate with the temperature control contractor to arrange for all heating and/or cooling coil control valves to be fully open during the initial system cleaning process and also shall coordinate with the temperature control contractor to arrange for the various valves in the central plant to be positioned/alternated such that all portions of the piping system are thoroughly flushed and cleaned.

C. At the conclusion of the initial system cleaning process the Contractor shall remove, clean, and replace each strainer in the piping system(s).

D. During the HVAC Systems Commissioning the Contractor shall remove strainers as directed by the Owner to demonstrate that the system is completely clean (less than 10% blockage on all strainers) and free of scale or other contamination. The Contractor shall also remove strainers as directed by the Owner during the last month of the warranty period to demonstrate that the system and strainers are still completely clean (less than 10% blockage on all strainers). Should the water system(s) and/or the strainers be found contaminated or dirty during either of the afore-mentioned observations, the Contractor shall clean the system(s) and strainers and re-treat the water system(s) as required until they are accepted as clean and properly treated.

1.4 OPERATING AND MAINTENANCE (O&M) MANUALS & INSTRUCTIONS

A. On-site start-up, service, and instruction shall be provided for each chemical treatment system by the water treatment specialist. Start-up of chemical treatment system and ongoing chemical treatment of each system shall commence within 24 hours of the time that the system is started.

B. Provide operation and maintenance manuals with initial dosage rates, ongoing dosage recommendations, and operation and maintenance instructions.

C. The Contractor shall provide a minimum of seven days written advance notice of the proposed day and time for the operation and maintenance instructions for the Owner's representatives.

D. Furnish and install an appropriately sized wall-mounted shelf in the central plant to allow for storage of the operating and maintenance manual, test kit, and monthly treatment reports. Provide fixed bookends on the shelf to prevent the manual(s) and test kit from sliding off of the shelf ends.

1.5 CHEMICAL TREATMENT SERVICE

A. During the first year warranty period, and during the period of time that the equipment is operational prior to commencement of the warranty period, the water treatment specialist shall provide complete chemical treatment service. The service shall include all required chemicals and a minimum of quarterly site visits to test and adjust the water treatment. The warranty period shall commence on the date that the Notice of Substantial Completion is executed by the Owner. The water treatment specialist shall also provide chemical treatment for a second year following the initial year of warranty service.

B. The water treatment specialist shall provide written reports of the activities performed and test results/water analyses for each visit. One copy of each report shall be left in an appropriate plastic folder at the chemical treatment equipment area on site.

C. At the end of the warranty period the treated equipment and piping systems shall be in as-new condition or the Contractor shall provide the required cleaning, service, repair, and/or replacement of any components that are not in as-new condition. The Contractor shall meet with the Owner's representative(s) during the last month of the warranty period so that the Owner's representative(s) can verify the condition of the equipment, piping systems, and strainers along with the Contractor.

1.6 ADDITIONAL TESTING AND REPORTING

A. For closed loop hydronic systems provide written copies of water quality test reports to the Architect/Engineer at the following milestones as noted:
   1. Sample of raw make-up tap water, prior to commencing any construction activity.
   2. Sample of water in existing hydronic systems scheduled to be modified or replaced, prior to commencing of any construction activity.
   3. Sample of water in new hydronic systems, after installation and initial system flushing, prior to the pipe cleaning phase.
   4. Sample of water in new hydronic systems at completion of the pipe cleaning phase, prior to treatment.
   5. Sample of water in new hydronic systems, after the initial chemical treatment phase.
   6. Sample of water in new hydronic systems, at project substantial completion.
   7. Sample of raw make-up tap water, at project substantial completion.
   8. Sample of water in new hydronic system, monthly after project substantial completion, for the duration of the warranty period.

PART 2 - PRODUCTS

2.1 GENERAL

A. Add a sufficient supply of a liquid oil dispersant/surfactant for initial cleaning of each piping system.

B. Provide a two year supply of chemicals for each closed loop piping system (heating water, chilled water, and heat pump water systems).

C. Note that the supply of chemicals and the two year service period are in addition to the chemicals and service required during start-up and check-out of the systems prior to commencement of the warranty period.

2.2 HEAT PUMP WATER SYSTEM CHEMICAL TREATMENT

A. Furnish and install a 12 gallon chemical bypass feeder, rated and stamped for a maximum working pressure of 200 psi at 375ºF. Feeder shall be Elbi Model DB-12-200Q with Model PFWH-20 strainer assembly, or approved equal. Install feeder in a valved bypass arrangement around the circulating pump(s). Provide a valved drain connection which shall be piped to the nearest floor drain. All piping shall be 1" diameter Type 'L' copper.

B. Each pot feeder shall incorporate a removable 20 micron pleated filter. Provide a minimum of three filters to be used in succession until all contaminants have been removed from the system. Provide another three filters for future use by the Owner.

C. Add an appropriate corrosion inhibitor to the recommended level of concentration that is appropriate for the equipment connected to the heating water system. Furnish the Owner with an appropriate test kit that can be utilized to evaluate proper treatment levels in between visits by the water treatment specialist. The chemical treatment specialist shall provide submittals that include the type of chemical(s) that will be added to the system and the concentration that will be placed and maintained in the system.

2.3 GLYCOL FEEDERS

A. Furnish and install completely assembled glycol feeders as scheduled on the drawings, Axiom Industries Model SF-100 (55 gallons) or Model DMF-300 (17 gallons), or approved equal. Feeder shall include a storage/mixing tank with molded-in liquid level gauge, 4” fill opening and cover, pump suction hose with inlet strainer, pressure pump with fuse protection, low fluid level pump cut-out float switch, manual diverter valve for purging air and agitating the contents of the storage tank, digital pressure switch (adjustable from 0 to 45 psi cut-out pressure), digital pressure display, visual alarm on low level, low level alarm with dry contacts for remote monitoring, and UL listed fused power supply adapter with LED power indicator light (supplied loose for field installation).

B. Furnish each glycol feeder with a low level alarm panel including an audible alarm.

2.4 EVAPORATIVE COOLING EQUIPMENT CHEMICAL TREATMENT

A. Provide five nylon mesh chemical treatment cylinders for each make-up air unit evaporative cooling section. One cylinder shall be placed in the evaporative cooler sump (adjacent to the fill valve) and the remaining four cylinders shall be turned over to the Owner for future use. Chemical treatment cylinders shall contain an NSF-certified, slow dissolving, combination scale and corrosion inhibitor. Chemical treatment cylinders shall be Nu-Calgon Evap-Treat Model 4173-06, or approved equal.

B. The mechanical contractor (or the test and balance contractor) shall adjust the bleed rate on each evaporative cooling section. The required bleed rate shall be confirmed with the Owner and the Engineer prior to testing/adjusting. Note that the continuous bleed is in addition to the drain/dump cycle(s) listed in the sequence of operation.

PART 3 - EXECUTION

3.1 COOLING TOWER PASSIVATION

A. Prior to and during startup the chemical treatment contractor shall be present to ensure that the upper wetted surfaces of the cooling tower (galvanized steel) undergo the passivation process described in the cooling tower manufacturer’s written installation instructions.

3.2 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.3 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 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) 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
Kitchen Exhaust 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. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) recommendations for all work in this section.

C. ASHRAE Standards: Comply with applicable portions of American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommendations for all work in this section.

D. 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.

E. 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. 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.

B. Fabricate ductwork with all accessories installed during fabrication to the greatest extent possible. Refer to Specification Section 233110 (HVAC Ductwork Accessories) for accessory requirements.

C. See Specification Section 230700 (HVAC Insulation) for additional related requirements.

D. 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.

E. 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.

F. 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.

G. 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.

H. 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.

I. 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 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.

J. 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 DUCTWORK

A. Round Ductwork: Provide spiral lock seam prefabricated duct, constructed and sealed for 4 inch pressure class. The requirement for spiral lock seam round ducts also applies to 2 inch pressure class round ductwork. Longitudinal seam round ductwork is not acceptable.

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

B. 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.

C. 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.

D. 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.

E. Round 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 on the listed fitting requirements.

F. Concealed Round 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

G. Exposed Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A653, in conformance with the listed manufacturing method, and in the listed minimum gauge.

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

H. Identification of Exposed Round 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 DUCTWORK INSULATION

A. 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 (HVAC Insulation) for associated requirements.

B. Internal Duct Liner Insulation (When Specified Below and/or Indicated on the Drawings)

1. Provide internal duct liner for the following, unless indicated otherwise on the drawings:
   a. The first 5 feet of rectangular ductwork downstream of each rooftop unit.
   b. The first 5 feet of rectangular ductwork downstream of each heat pump.
   c. Rectangular transfer air ducts.
   d. Rectangular ductwork that is exposed in a mechanical room, mezzanine area, or other space and is less than 8’-0” above finished floor.
   e. Rectangular ductwork elsewhere as noted on the drawings.
2. Internal duct liner shall be 1-1/2” thick ArmaFlex FS Self-Adhering Duct Liner, or approved equal, with an insulating value of R-6 and a 25/50 flame and smoke spread rating in accordance with ASTM E84.
3. Alternatives to applying ArmaFlex FS Duct Liner without the self-adhering feature include using ArmaFlex 520 Adhesive or using ArmaFlex Low VOS Spray Adhesive.
4. Additionally secure duct liner with 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 edges and seams.
5. Cut and secure internal duct liner in strict accordance with the duct liner manufacturer’s written application instructions.
6. Adjust duct sizes to accommodate liner thickness to provide the net internal duct dimensions shown on the drawings.

2.7 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.

2.8 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.g. 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

2.9 DUCT ACCESS PANELS

A. Provide access panel sections in prefabricated, factory-built ducts for access to fire dampers, control equipment, etc. as specified in Specification Section 233110 (HVAC Ductwork Accessories). Access panel size shall be duct diameter wide by duct diameter high for all ducts under 24 inches. Ducts over 24 inches in diameter shall have 24 inch by 18 inch access panels. Minimum access panel size shall be 6 inch by 6 inch.

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.

2.12 KITCHEN EXHAUST DUCTWORK

A. All exhaust ductwork and fittings serving kitchen hoods shall be Type 316L stainless steel with welded joints and shall be constructed for 2 inch or 4 inch pressure class as appropriate for the associated equipment and duct arrangement.

B. All control dampers in stainless steel ductwork shall be constructed of stainless steel and shall have flanged connections.

2.13 ADDITIONAL REQUIREMENTS FOR TYPE 1 KITCHEN GREASE HOOD EXHAUST DUCTS

A. Install ducts in accordance with NFPA 96 (Ventilation Control and Fire Protection of Commercial Cooking Operations), SMACNA Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines, and Uniform Mechanical Code Section 510. Do not penetrate fire rated assemblies except as allowed by applicable building codes and the authorities having jurisdiction.

B. Install all ducts without dips or traps that may hold grease. Ducts on horizontal runs up to 75 feet long shall be sloped at a minimum of 1/4 inch per foot to allow grease to drain back to the hood. Ducts on horizontal runs longer than 75 feet long shall be sloped at a minimum of 1 inch per foot. Drains shall be installed at low points in horizontal ducts, and shall be continuously welded to the exhaust duct.

C. All joints shall be welded and shall be telescoping, bell, or flange joint type per NFPA 96.

D. Install stainless steel fire rated access doors at each change in direction and at maximum intervals of every 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on the drawings. Grease duct access doors shall be Ductmate Ultimate with insulation kit, outer plate, washers, fasteners, and signage. Duct access doors shall be installed in strict conformance with the manufacturer’s written installation instructions and the UL listing.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

A. Assemble and install ductwork to achieve air tight and noiseless (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 rectangular ducts pass through interior partitions, masonry walls, 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. Where spiral ducts pass through interior partitions, masonry walls, and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with 6” (approx.) conical escutcheons. Overlap opening on all sides by at least 1-1/2 inches.

F. 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.

G. 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.

H. 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.g.	3” w.g.	4” thru 10” w.g. 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

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) 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). All turning vanes shall be double wall style. Turning vanes shall be SMACNA ‘Large’ (R=4.5”/SP=3.25”) for duct widths 14 inches and larger and shall be SMACNA ‘Small’ (R=2.0”/SP=1.5”) for duct widths 12 inches and smaller.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering turning vanes which may be incorporated in the work include the following:
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.g. or less). Test holes installed in medium pressure ductwork (above 2” w.g.) 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:
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 MANUAL VOLUME DAMPERS, CONTROL DAMPERS, AND BACKDRAFT DAMPERS

A. Manual Dampers: Provide dampers of single-blade type or multi-blade type constructed in accordance with SMACNA (HVAC Duct Construction Standards), latest edition. Damper blades shall not exceed 6 inches in width, except that 8 inch wide dampers may be used in 8 inch wide ducts.

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, wall plate with ports, and battery powered remote control device. Dampers shall be Greenheck Model RBDR-50, Pottorff Model RD-10R, 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 ½" 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:

Greenheck
Ruskin
Pottorff
Air Balance

2.6 COMBINATION FIRE-SMOKE DAMPERS

A. Greenheck Model FSD-311, Ruskin Model FSD-60, or approved equal, with test switch.
1. Both UL555 and UL555S Classified, rated as a 1-1/2 hour fire damper and as a Leakage Class I smoke damper.
2. Elevated Temperature Rating: 350ºF
3. Airflow Rating: 4,000 fpm
4. Differential Pressure Rating: 4 inches w.g.

B. Construction
1. Frame: Hat-shaped channel, roll-formed, galvanized steel with interlocking gusseted corners. Low profile geometry and 20 gauge top and bottom frame members on damper sizes less than 17 inches high to maximize free area.
2. Blades: 14 gauge galvanized steel with airfoil blades.
3. Blade Seals: Silicone rubber mechanically secured to blade.
4. Jamb Seals: Flexible stainless steel compression type.
5. Axles: Minimum 1/2" diameter zinc plated steel.
6. Bearings: Stainless steel sleeve type rotating in polished extruded holes in the damper frame.
7. Linkage: Non-adjustable and concealed in the damper frame.
8. Fire Closure Device: Reusable/Resettable link.

C. Fire Closure Temperature:
1. The fire-smoke damper shall be equipped with a factory installed heat responsive device rated to close the damper when the temperature at the damper reaches 165°F.

D. Actuator:
1. Electrical: 120 Volt, two-position, fail closed.
2. Mounting: External (Outside of Duct).

E. Required Options:
1. Test switch with open/closed indication.
2. Dual contacts to allow monitoring by the fire alarm panel and direct digital control system.
3. Factory sleeve.
4. Factory access door.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire-smoke dampers which may be incorporated in the work include the following:

Greenheck Model FSD-311
Ruskin Model FSD-60

2.7 DUCT SMOKE DETECTORS

A. Duct smoke detectors hsall 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 the duct smoke detectors and wiring between duct smoke detectors and the associated mechanical equipment shall be 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 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 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 smoke detectors shall be manufactured by Edwards, Notifier, or approved equal. On projects where the 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 detectors shall include dual auxiliary contacts for interface with the fire alarm system and the direct digital control system (when applicable).

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) 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:
In-Line Centrifugal Fans
Kitchen Exhaust Fans
Exhaust Hoods
Roof Mounted Intake/Relief Hoods
Pre-Fabricated Seismic Roof Curbs
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 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 CSP-A, Greenheck 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 air flow and sound.

C. Motor Type: Provide open drip-proof (ODP) motor for Greenheck Model CSP-A. Motor shall be permanently lubricated sleeve bearing type, mounted on vibration isolators, suitable for speed control. Provide electrically commutated (EC) motor for Greenheck Model SP-AP with 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
PennBarry
Cook

2.2 IN-LINE CENTRIFUGAL FANS

A. Provide direct drive in-line fans of sizes and arrangement as indicated, and of capacities and having accessories as scheduled. Fans shall be Greenheck SQ, or approved equal.

B. Ratings: Test and rate fans in accordance with ASHRAE Standards. Provide with AMCA Certified Ratings Seal for both air flow and sound.

C. Fan Units: Provide factory-assembled and tested fan units consisting of housing, wheel, fan shaft, bearings, and fan drive. Clean, condition, and prime paint sheet metal parts prior to final assembly. Apply final coat of enamel to exterior surfaces after assembly.

D. Wheels: Balance wheels statically and dynamically near operating speed.

E. Backdraft Damper: Provide a factory-furnished, field-installed backdraft damper at each in-line exhaust fan.

F. Bearings: Provide sealed, pillow block type bearings, rated for a minimum life of 200,000 hours.

G. Motors: Provide open drip-proof motors with ball or sleeve bearings. Provide split phase or capacitor start motors for fractional horsepower, with resilient base. Provide induction motors for integral horsepower, with rigid base. Provide non-fusible type disconnect switch for all 120 volt fans. Where scheduled, provide Greenheck Vari-Green EC motor with factory furnished speed control.

H. Drives: Where scheduled provide V-belt drives selected for a 1.5 service factor. Provide adjustable pitch sheave selected for midpoint at design conditions.

I. Available Manufacturers: Subject to compliance with requirements, manufacturers offering in-line centrifugal fans which may be incorporated in the work include the following, or approved equal:

Greenheck
PennBarry
Cook

2.3 KITCHEN EXHAUST FANS

A. General: Provide centrifugal type fans, curb mounted, of type, size, and capacity as scheduled on the drawings, and as specified herein. Fans shall be Greenheck Cube, or approved equal.

B. Ratings: Test and rate fans in accordance with ASHRAE standards. Provide with AMCA Certified Rating Seal for air flow and sound.

C. Type: Centrifugal fan, up-blast type, direct drive or belt drive as scheduled. Provide capacitor-start, induction-run type motor for belt drive fans.

D. Electrical: Provide a factory-wired non-fusible type disconnect switch at the motor in the fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.

E. Provide grease hood exhaust fans with ventilated curbs, grease trough and drain fittings, and other accessories as required by code. Curb height shall be as indicated on the drawings and shall accommodate the roof slope. Curb shall be hinged style, suitable for cleaning the lower housing, fan impeller, and ductwork. When a kitchen exhaust hood is scheduled on the drawings, the associated make-up air unit and exhaust fan shall be provided by the same manufacturer (to ensure control interface compatibility).

F. 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
PennBarry
Cook

2.4 EXHAUST HOODS

A. Hoods shall be constructed of a minimum of 18 gauge 400 series stainless steel. Hoods shall be constructed using the standing seam method for optimum strength and with a Performance Enhancing Lip (PEL) to improve capture efficiency by turning air back into the hood. All seams, joints, and penetrations of the hood enclosure shall be welded and/or liquid tight. Lighter material gauges, alternate material types, and alternate finishes are not acceptable.

B. Provide vapor-proof, UL listed LED light fixtures (restrictions may apply) which shall be pre-wired to a junction box situated at the top of the hood for field connection. Wiring shall conform to the requirements of NFPA 70.

C. Canopy hoods shall be built in accordance with the NFPA 96, the UMC, and shall bear the NSF Seal of Approval.

D. Available manufacturers: Subject to compliance with requirements, manufacturers offering exhaust hoods which may be incorporated in the work include the following, or approved equal:
Greenheck
PennBarry

2.5 ROOF MOUNTED INTAKE AND RELIEF HOODS

A. Provide hoods, curb mounted, of size noted on drawings and as specified herein. Hood style and manufacturer shall match the centrifugal roof exhaust fans. Intake hoods shall be Greenheck Model GRSI, or approved equal.

B. Relief hoods shall be Greenheck Model GRSR with backdraft damper, or approved equal.

C. Bird Screens: Provide removable bird screens, 1/2” mesh 16 gauge aluminum or brass wire.

D. Provide backdraft damper in the neck of each relief air hood (not required on hoods serving inline fans that are equipped with integral backdraft dampers).

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering intake and relief hoods which may be incorporated in the work include the following, or approved equal:
Greenheck
PennBarry
Cook

2.6 PRE-FABRICATED SEISMIC ROOF CURBS

A. See Specification Section 230500 (Basic Materials and Methods for HVAC).

2.7 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. Electrical disconnect shall be placed in a location accessible without the use of a ladder.

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
Accurex

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) 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 9A 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 30/30 Dual 9, or approved equal.
2. The filter manufacturer shall have evidence of facility certification to ISO 9001:2015.

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 9 when evaluated under ASHRAE Standard 52.2. Additionally, filters shall have a MERV-A rating of 9 when tested per Appendix J of the same standard.
2. The filter shall have a performance rating of ePM10 - 55% when evaluated in accordance with ISO Filter Testing Standard16890.
3. The initial resistance to airflow for 2 inch thick filters shall not exceed 0.28” w.c. at 500 fpm, and 0.20” w.c. at 400 fpm.
4. The initial resistance to airflow for 4 inch thick filters shall not exceed 0.25” w.c. at 500 fpm, and 0.17” w.c. at 400 fpm.
5. The recommended filter change-out resistance is 1.0” w.c.

2.3 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) 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:

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 50 20 - CONDENSING BOILERS

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) are hereby made a part of this section.

1.2 SUMMARY

A. This Section includes packaged, factory fabricated and assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for heating hot water systems.

1.3 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Source quality control test reports: Indicate and interpret test results for compliance with performance requirements before shipping.

D. Field quality control test reports: Indicate and interpret test results for compliance with performance requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Provide operation and maintenance data for boilers, to include emergency procedures, operation, and maintenance requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with the ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to ‘Gas and Oil Fired Boilers - Minimum Efficiency Requirements’.

D. AHRI Compliance: Boilers shall be AHRI listed and shall meet the minimum efficiency specified under AHRI BTS-2000 as defined by the Department of Energy in 10 CFR Part 431.

E. ANSI Compliance: Boilers shall be compliant with ANSI Z21.13 test standards.

F. CSA Compliant: Boilers shall be compliant with CSA certification requirements.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor bolt inserts into concrete bases.

1.7 WARRANTY

A. Standard Warranty: The boilers shall include the manufacturer's standard form warranty in which the manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within the specified warranty period. Warranty period for fire tube condensing boilers shall be as follows:

1. The heat exchanger, pressure vessel, and condensation collection basin shall carry a 10 year limited warranty against defects in materials or workmanship.
2. The heat exchanger/pressure vessel shall be warranted against thermal shock for the lifetime of the boiler.
3. The burner and O_2 sensor shall carry a 5 year warranty against defects in materials or workmanship from the date of shipment.
4. All other components shall carry a one year warranty from date of boiler startup or 18 months from shipment if startup cannot be successfully conducted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering boilers which may be incorporated in the work include the following, or approved equal:

Lochinvar Model FTX
Cleaver Brooks ClearFire-CE

2.2 CONSTRUCTION

A. Description: The boiler shall be natural gas fired, fully condensing, fire tube design. The boiler shall be factory fabricated, factory assembled, and factory tested, fire tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket' flue gas vent and combustion air intake connections, water supply, return, and condensate drain connections, and controls.

B. The boiler shall be constructed with a heavy gauge steel jacket assembly, primed and painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided for observing the burner flame and combustion chamber. The boiler (FTX 1000 only) shall be supplied with an integrated air filter to filter the combustion air prior to entering the burner.

C. Heat Exchanger: The heater exchanger shall bear the ASME H stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of fully welded stainless steel and fire tube design. The heat exchanger shall be designed for single pass water flow to limit the water side pressure drop. There shall be no banding material, bolts, gaskets or O-rings in the heat exchanger design. Cast iron, aluminum, or condensing copper tube boilers are not acceptable.

D. Condensate Collection Basin: Fully welded stainless steel.

E. Pressure Vessel: The pressure vessel shall be constructed in accordance with the ASME Section IV pressure vessel code. The pressure vessel shall be designed for single pass water flow to limit the water side pressure drop. The water side pressure drop shall not exceed 2.2 psi when operating at 75 gpm.

F. The pressure vessel shall contain a volume of water no less than the following:

Boiler Model	Boiler Input Capacity	Water Content
FTX 500	500 mbh	11.9 gallons

G. Burner: The burner shall be a pre-mix design constructed of high temperature stainless steel with a woven Fecralloy outer covering to provide smooth operation at all modulating firing rates. The boiler shall be supplied with a negative pressure regulation gas valve and be equipped with a pulse width modulation blower system to precisely control the fuel/air mixture to the burner. The boiler shall operate in a safe condition with gas supply pressures as low as 4 inches of water column. The burner flame shall be ignited by direct spark ignition with flame monitoring via a flame sensor.

H. Gas Train: The boiler shall be capable of the following minimum turndowns:

Boiler Model	Boiler Input Capacity	Turndown	Minimum Input
FTX 500	50 mbh	10:1	500 mbh

I. Ignition: Spark ignition with 100 percent main valve shutoff with electronic flame supervision.

J. High Altitude: The boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.

K. High altitude operation shall be certified at a minimum of 4,500 feet above sea level by a third party organization. High altitude boilers shall be certified from 3,000 to 12,000 feet above sea level.

L. The boiler shall carry a CSA certification for high altitude operation up to 12,000 feet. High altitude operation shall be third party certified and be conducted in an ISO 17025 recognized laboratory; boilers without this high altitude certification are not acceptable.

2.3 TRIM AND ACCESSORIES

A. Safety Relief Valve: Furnish ASME rated 50 psi relief valve, unless otherwise indicated on drawings. Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

B. Pressure Gauge: Minimum 3-1/2 inch diameter. Gauge shall have normal operating pressure about 50 percent of full range.

C. Drain Valves: Minimum 3/4 inch valve or nozzle size with hose end connection.

D. Condensate Neutralization Kit: provide a factory-supplied condensate trap with condensate trip sensor, and high capacity condensate receiver, pre-filled with an appropriate neutralizing medium. Provide 40 lbs of spare neutralization media for future use by the Owner.

2.4 CONTROLS

A. Boiler controls shall feature a standard, factory installed 7” LCD screen display with the following standard features:

1. Variable Speed Boiler Pump Control: Boiler may be programmed to send a 0-10 VDC output signal to an ECM or VFD boiler pump to maintain a designed temperature rise across the heat exchanger. The boiler shall be able to operate in this mode with a minimum temperature rise of 20°F and a maximum temperature rise of 60°F. Project specific temperature rise shall be as listed on the drawings.
2. Password Security: Boiler shall have a different password security code for the user and the installer to access adjustable parameters.
3. Outdoor air reset: The boiler shall calculate the setpoint using a field installed, factory supplied outdoor sensor and an adjustable reset curve.
4. Pump exercise: The boiler shall energize any pump it controls for an adjustable time (initially 5 minutes) if the associated pump has been off for a time period of 24 hours.
5. Ramp delay: The boiler shall have the capability to be programmed to limit the firing rate based on six limits steps and six time intervals. The boiler shall be configured at the project site for a 5 minute delay per each 20% modulation rise up to 100% (adjustable) to further mitigate unnecessary burner cycles.

6. Boost function: The boiler may be programmed to automatically increase the setpoint a fixed number of degrees (adjustable by installer) if the setpoint has been continuously active for a set period of time (time adjustable by installer). This process will continue until the space heating demand ends.
7. Domestic hot water priority: When applicable, the boiler shall make the domestic hot water call for heat a priority over any space heating call and adjust the boiler setpoint to the domestic hot water boiler setpoint.
8. Domestic hot water modulation limiting: When applicable the boiler shall be programmed to limit the maximum domestic hot water firing rate to match the input rating of the indirect tank coil.
9. Domestic hot water night setback: When applicable the boiler may be programmed to reduce the domestic hot water tank setpoint during a certain time of the day.
10. PC port connection: The boiler shall have a PC port allowing the connection of PC boiler software.
11. Time clock: The boiler shall have an internal time clock with the ability to time and date stamp lock-out codes and maintain records of runtime.
12. Service reminder: The boiler shall have the ability to display a yellow colored service notification screen based upon months of installation, hours of operation, and number of boiler cycles. All notifications shall be adjustable by the installer.
13. Multiple pump control: The boiler shall have the ability to control the boiler pump, system pump, and the domestic hot water pump if desired.
14. Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler shall display an anti-cycling blocking on the screen until the time has elapsed or the water temperature drops below the anti-cycling differential parameter. The anti-cycling control parameter shall be adjustable and shall be set initially to 5 minutes.
15. Night setback: the boiler shall be capable of being programmed to reduce the space heating temperature setpoint during a certain time of the day.
16. Freeze protection: The boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45°F. When the boiler water temperature falls below 37°F the boiler shall automatically turn on. Boiler and pumps shall turn off when the boiler water temperature rises above 43°F.
17. Isolation valve control: When required on the drawings, the boiler shall have the ability to control a 2-way motorized control valve. The boiler shall also be able to force a fixed number of valves to always be energized regardless of the number of boilers that are firing.
18. BMS integration with 0-10V DC input: Control shall allow an option to enable and control setpoint temperature or control firing rate by sending the boiler a 0-10V input signal.
19. Data logging: The boiler shall have non-volatile data logging memory including the last 10 lockouts, hours running, and ignition attempts, all viewable on the boiler screen.

B. The boiler shall have a built in cascade controller to sequence and rotate the lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different btu inputs without utilization of an external controller. The factory installed, internal cascade controller shall include each of the following:
   1. Lead lag.
   2. Efficiency optimization: The control module shall allow multiple boilers to fire at the minimum firing rate in lieu of lead/lag operation.
   3. Front end loading.
   4. Boiler Rotation: The control module shall change the lead boiler every hour for the first 24 hours after initializing the cascade and after that the lead will be changed every 24 hours.

C. Boiler operating controls shall include the following devices and features:
   1. Setpoint Adjustment: Setpoints shall be adjustable.
   2. Operating Pressure Control: Factory-wired and mounted to cycle burner.
   3. Sequence of Operation: Factory-installed controller to modulate burner firing rate to maintain system water temperature in response to call for heat.
   4. Sequence of Operation: Electric, factory-fabricated and factory-installed panel shall be capable of controlling burner firing rate to reset supply water temperature inversely with outside air temperature.

D. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
   1. High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
   2. Low Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.
   3. Blocked Inlet Safety Switch: Manual reset pressure switch field mounted on boiler combustion-air inlet.
   4. High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.
   5. Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.
   6. Low Air Pressure Switch: Pressure switches shall prevent burner operation on low air pressure. Switch shall be manually reset on the control interface.
   7. Audible Alarm: Factory-mounted on control panel with silence switch; shall sound an alarm for any lockout condition.

E. Building Automation System Interface: Provide factory-installed BACnet MSTP gateway interface to enable the building automation system to monitor, control, and display boiler status and alarms.

2.5 MAGNETIC FILTER

A. Provide a magnetic filter at the inlet of each boiler. Magnetic filter shall be BoilerMag, or approved equal. Provide BoilerMag Model XT for boiler inlet pipe sizes 2” and larger. Magnetic filters shall comply with the following requirements.
   1. Magnetic filter shall be designed, constructed, and stamped in accordance with Section VIII, Division I of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors.
   2. Magnetic filter shall be rated for 174 psi maximum working pressure.
   3. Magnetic filter shall have a maximum operating temperature rating of 300°F.
   4. Magnetic filter body shall be constructed of 304 stainless steel.
   5. Magnetic filter tube cartridge shall be constructed of 316 stainless steel.
   6. Magnetic filter body shall be minimum four times the nominal inlet/outlet pipe diameter.
   7. Magnetic filter shall include a threaded blow-down connection to allow for sediment to be regularly flushed out of the unit.
   8. Magnetic filter shall include a threaded air removal connection on top of the unit with an integral automatic air vent.
   9. Magnetic filter shall include permanent rare earth neodymium iron boron magnets with 9,000 gauss strength. Magnet grade shall be N42SH.
   10. Magnetic filter Model XT shall be available with flanged end connections.

11. Accessories provided shall include blow-down valve and air vent
12. Provide written operating and maintenance instructions for use by the Owner.
13. Provide 3 year parts and labor warranty.
14. The Contractor shall field install ball or butterfly type isolation valves immediately at the inlet and outlet of the magnetic filter.
15. The Contractor shall field install a hose end fitting at the filter blow-down connection.

2.6 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections shall be as specified in Division 26.

B. Single Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices necessary shall provide for a single point field power connection to the boiler.

C. Electrical characteristics shall be as indicated on the drawings.

2.7 VENTING AND COMBUSTION AIR

A. See Specification Section 235100 (Condensing Gas-Fired Equipment Vents).

B. Venting and combustion air intake piping shall be installed per the approved venting method shown in the vent manufacturer's installation and operation manual as appropriate to conform with the arrangement shown on the drawings.

C. Refer to the equipment manufacturer's installation and operation manual for detailed venting instructions and approved vent manufacturers.

D. Combustion air intake piping length shall not exceed 100 total equivalent feet.

2.8 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory-adjust the burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, carbon monoxide in flue gas, and to achieve the design combustion efficiency. Perform hydrostatic testing.

B. Test and inspect factory-assembled boilers, before shipping, according to the ASME Boiler and Pressure Vessel Code.

C. The Owner shall be allowed access to source quality control testing of boilers if so desired.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine rough-in for concrete equipment bases, anchor bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations. Final boiler locations indicated on the drawings are approximate. Determine the exact locations before rough-in of piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Install boilers level on concrete bases. Concrete base shall be as specified in 230500 (Basic Materials and Methods for HVAC).

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field mounted electrical devices.

3.3 CONNECTIONS

A. Install piping adjacent to boiler to allow service and maintenance.

B. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection.

C. Connect gas piping to boiler gas train inlet with union. Piping shall be at least full size of equipment connection. Provide a reducer if required.

D. Connect hot water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

E. Install piping from safety relief valves to nearest floor drain.

F. Boiler Venting: Install flue venting kit and combustion air intake as indicated on the drawings.

G. Ground equipment according to the requirements listed in Division 26.

H. Connect wiring according to the requirements listed in Division 26.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory trained and authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Perform tests and inspections and prepare associated test reports.

B. Tests and Inspections

1. Perform installation and startup checks according to manufacturer's written instructions. Complete startup form included with boiler and provided to Owner and manufacturer.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion efficiency.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   a. Check and adjust initial operating setpoints and high and low limit safety setpoints of fuel supply, water level and water temperature.
   b. Set field adjustable switches and circuit breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested, within 12 months of the date of substantial completion, provide on-site assistance in adjusting the system to suit actual occupied conditions. Provide up to two visits to the project site for this purpose.

D. Performance Tests

1. Engage a factory trained and authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
3. Perform field performance tests to determine capacity and efficiency of the boilers.
4. Repeat tests until results comply with requirements indicated.
5. Provide analysis equipment required to determine performance.
6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
7. Notify Architect/Engineer in advance of proposed test dates.
8. Perform a combustion analysis after installation and adjust gas valve per the installation and operations manual and note results in startup report.
9. Document test results in a report and submit to Architect/Engineer.

3.5 FACTORY AUTHORIZED STARTUP AND TRAINING

A. Engage a factory trained and authorized service representative for boiler startup and to train the Owner's maintenance personnel to adjust, operate, and maintain the boilers.

END OF SECTION

SECTION 23 51 00 - CONDENSING GAS-FIRED EQUIPMENT VENTS

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) are hereby made a part of this section.

1.2 SUMMARY

A. This section includes vent and combustion air materials and requirements for condensing type gas-fired equipment installed indoors. Such equipment includes condensing type boilers, water heaters, unit heaters, duct heaters, furnaces, etc.

1.3 SUBMITTALS

A. Product Data: Include product data, temperature ratings, and furnished accessories.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Vent materials shall be listed in accordance with UL 1738.

1.5 COORDINATION

A. All venting and combustion air provisions shall comply with the installation requirements of the equipment manufacturer.

PART 2 - PRODUCTS

2.1 VENT AND COMBUSTION AIR MATERIALS AND INSTALLATION

A. General: Vent and combustion air intake piping shall be installed per an approved venting method shown in the vent manufacturer's installation manual as appropriate to conform to the arrangement shown on the drawings.

B. Vents

1. All vents shall be installed with clearance to combustibles that conforms to the equipment and vent manufacturer's UL listing.
2. Vent materials shall be UL 1738 listed, sealed Category IV, stainless steel. Vents shall comply with the direct vent requirements listed in the vent manufacturer's installation instructions.
3. Vent sections that are installed in a mechanical room or other areas exposed to occupants shall be double wall (for personnel safety purposes).
4. Vent sections that are enclosed or concealed may be single wall.

C. Combustion Air Intakes

1. Combustion air intake piping shall be one of the following:
   a. 28 gauge minimum spiral lockseam galvanized duct.
   b. Polypropylene that is 25/50 rated per ASTM E84. Acceptable products include DuraVent PolyPro, InnoFlue, or approved equal. Provide all necessary adapters, fittings, gaskets, etc. as required for a complete installation.

END OF SECTION

SECTION 23 75 00 - WATER SOURCE 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) are hereby made a part of this section.

1.2 SUMMARY

A. Furnish and install water source 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

Available Manufacturers: Subject to compliance with requirements, the Basis of Design Manufacturer offering water source heat pumps which may be incorporated in the work is as follows:
Daikin

Alternate Manufacturers that demonstrate compliance with requirements.

2.2 GENERAL

A. Furnish and install water source 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.

B. Units shall be supplied completely factory assembled, piped, internally wired, fully charged with R-32 or R-454B refrigerant. Units shall be horizontal or vertical type and capable of operating over an entering water temperature range from 55°F to 110°F on heat pump loop models, and 20° to 110°F on ground loop (geothermal) models. All equipment shall be AHRI rated and certified in accordance with AHRI Standard 920 and shall be tested, investigated, and determined to comply with the requirements of the applicable standards for Heating and Cooling Equipment (UL-60335-2-40 Version 2 for the United States, and CAN/CSA-C22.2 No. 60335-2-40 Version 2 for Canada. Each unit shall be ETL Listed. Each unit shall be run tested at the factory.

2.3 CASING AND CABINET

A. Unit cabinet shall be fabricated from heavy gauge G-60 galvanized sheet metal. Interior surfaces shall be lined with 1/2 inch, 1-1/2 lb dual density coated fiberglass insulation. All insulation shall have the edges sealed or tucked in order to prevent introduction of fibers into the discharge air. Standard cabinet insulation shall meet NFPA 90A/90B requirements, air erosion and mold growth limits of UL 181, fungi resistance complying with ASTM G21 and/or ASTM C1338, and bacterial resistance per ASTM G22. All insulation shall have a flame spread rating of less than 25 and a smoke developed rating of less than 50 per ASTM E84..

B. Cabinets shall have separate openings and knockouts for entrance of line voltage and low voltage control wiring. Supply and return water connections shall be FPT fittings and shall be securely mounted flush to the cabinet corner post allowing for connection to a flexible hose without the use of a back-up wrench.

C. Units shall include three access panels, two for the compressor compartment, and one for the blower compartment. Units shall have an insulated panel separating the blower compartment from the compressor compartment.

D. Required Option: Compressor Sound Reduction Package
   1. 1 inch thick dual layer insulation on entire unit (Unit Sizes 007 - 019).
   2. 1 inch thick dual layer insulation in the air handling section (Unit Sizes 024 - 070), 1/2 inch thick dual density fiberglass insulation in the compressor section, and compressor sound blanket (Unit Sizes 024 - 070).

E. Required Option: Water Pressure Differential Switch (Factory Installed and Wired)

2.4 REFRIGERANT CIRCUIT

A. Units shall have a R-32 or R-454B sealed refrigerant circuit, which includes a rotary or scroll compressor, an aluminum lanced fin and rifled copper tube refrigerant-to-air heat exchanger, thermostatic expansion valve, reversing valve, and a coaxial tube-in-tube refrigerant-to-water heat exchanger. The airside coil shall be rated at 600 psi working pressure. The coaxial coil shall be made of a copper inner tube and a painted steel outer tube and be rated at 500 psi working pressure on the waterside and 600 psi working pressure on the refrigerant side. The compressor shall have thermal overload protection.

B. The compressor shall have a dual level vibration isolation system. The compressor shall be mounted on vibration isolation grommets to a heavy gauge compressor mounting plate, which shall then be isolated from the cabinet base to minimize vibration transfer.

C. Safety controls shall include a minimum of 3 safety devices; high refrigerant pressure switch, low refrigerant pressure switch, and a low refrigerant suction temperature sensor. The low refrigerant suction temperature sensor shall provide freeze protection for the water coil and the air coil. Refrigerant gauge access fittings shall be factory installed on the high and low pressure refrigerant lines to facilitate field service. Activation of any safety device shall prevent the compressor from operating via a microprocessor lockout circuit. The lockout circuit shall be resettable at the thermostat or at the unit disconnect switch.

D. *Required Option:* Cupro-Nickel Refrigerant-to-Water Heat Exchanger. Refrigerant-to-water heat exchanger shall be of copper-nickel inner water tube and steel refrigerant outer tube design, rated for a 600 psi working refrigerant pressure and a 450 psi working water pressure. Water lines shall also be of cupro-nickel construction.

2.5 FAN AND MOTOR ASSEMBLY

A. The fan motor shall be permanently lubricated, variable speed, constant cfm, electronically commutated. Field adjustable cfm settings shall be accomplished from a 4 position switch in the control box. The constant cfm EC motor shall have the ability to reduce the cfm as the space temperature approaches the room temperature setpoint. Units with 460 volt/3 phase power require a 4th neutral wire.

2.6 ELECTRICAL AND CONTROLS

A. A control box shall be located within the unit compressor compartment and shall contain a 50VA or 75VA transformer, 24 volt activated, 2 pole compressor contactor, terminal block for thermostat wiring and solid state controller for complete unit operation. Electro-mechanical operation is not acceptable. Units shall be name-plated for use with time delay fuses or circuit breakers. Unit controls shall be 24 volt and provide heating or cooling as required by the remote thermostat/sensor.

B. Units shall have a microprocessor based control system. The unit control logic shall be capable of communication over a BACnet communications network. The BACnet communication module shall be capable of supporting full MSTP BACnet implementation. The microprocessor shall also support communications with the MicroTech Smart-Source controller. The physical interface to a BACnet BMS network shall be through an industry standard RS-485 transceiver capable of existing on an RS-485 network of up to 64 nodes. The unit controller shall be factory programmed and tested with all the logic required to monitor and control heating and cooling operation. The controller sets the unit mode of operation, monitors water and air temperatures, and can communicate fault conditions via a BACnet communications network. Units outfitted with MicroTech and BACnet Communication modules include return air, discharge air and leaving water temperature sensors. Space temperature sensor options include a setpoint adjustment, tenant override button, and the capability of substituting the return air sensor with a wall mounted room temperature sensor.

C. Each communicating unit controller performs the following unit operations:
   1. Enable heating and cooling to maintain space temperature set point at the room sensor.
   2. Enable fan and compressor operation.
   3. Monitor all safety controls.
   4. Monitor discharge and return air temperature.
   5. Monitor leaving water temperature.
   6. Relay status of all vital unit functions.
   7. Support optional control outputs.

D. If there are no current alarm conditions, a green LED on the annunciator board shall indicate the occupied unit operating mode. If an alarm condition exists, the MicroTech Smart-Source unit controller shall send the fault condition to the LED annunciator to assist in troubleshooting.

2.7 PIPING

A. Supply and return water connections shall be FPT copper fittings fixed to the corner post, which eliminate the need for backup pipe wrenches. With vertical units, the condensate connection shall be a 3/4 inch PVC socket with an internally trapped hose that can be routed to the front or side corner post locations.

2.8 HANGER KIT (HORIZONTAL UNITS ONLY - FOR FIELD INSTALLATION)

A. The hanger kit shall consist of galvanized steel brackets, bolts, lock washers, and isolators and shall be designed to fasten to the unit bottom panel for suspension from 3/8 inch threaded rods. Brackets shall not inhibit filter removal in any way.

PART 3 - EXECUTION

3.1 HEAT PUMP INSTALLATION

A. Install heat pumps in the locations and arrangements indicated on the drawings.

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 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.

3.3 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 81 00 - OUTDOOR MAKE-UP AIR UNITS

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) are hereby made a part of this section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and configuration of outdoor make-up air unit.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 (Systems and Equipment).

C. Shop Drawings: For each type and configuration of outdoor make-up air unit.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.3 SUBMITTALS

A. Sample warranty.

B. Seismic qualification certificate for roof curb.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. ASHRAE Compliance: Comply with the applicable requirements listed in ASHRAE 62.1, Section 5 (Systems and Equipment) and Section 7 (Construction and Startup).

C. ASHRAE Compliance: Comply with the applicable requirements listed in ASHRAE 90.1 Section 6 (Heating, Ventilating, and Air Conditioning).

1.6 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.

1.7 WARRANTY

A. The manufacturer shall repair or replace any components of the outdoor make-up air units that fail in materials or workmanship within the one year warranty period. The manufacturer shall provide a 5 year extended warranty for the heat exchanger.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide make-up air units as manufactured by one of the following, or approved equal:

Greenheck
CaptiveAire
RuppAir
Reznor

2.2 CONSTRUCTION

A. The unit with integral heating and cooling shall be fully assembled at the factory and consist of an insulated metal cabinet, with bird screen, evaporative cooling module, motorized intake damper, motorized recirculating damper where specified, supply air low limit sensor, sensors, seismic curb assembly, service receptacle, filter assembly for intake air, supply air blower assembly, and an electrical control center. All specified components and internal accessories shall be factory installed and tested and prepared for single-point line voltage connection.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CABINET

A. Materials: Formed double wall insulated metal cabinet fabricated to permit access to internal components for maintenance.

1. Outside casing: Factory painted baked enamel finish (sand color), 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvaneal steel. Base rail shall be 12 gauge, galvanized (G90) steel.

2. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and 90B and erosion requirements of UL 181.

1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.

a. Thickness: 1 inch.

b. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C411.

c. Location and application: Full interior coverage of entire cabinet to include insulated walls and roof of unit shall be semi-rigid type and installed between inner and outer shells of all cabinet exterior components.

C. Access panels: Unit shall be equipped with hinged access panels to provide easy access to all major components. Access panels shall be fabricated of 18 gauge galvanized G90 steel. Removable access panels shall incorporate a formed drip edge.

D. Blower assembly: Blower assembly shall consist of a direct drive electric motor and a double width, double inlet forward curved blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on minimum 1.125” thick neoprene vibration isolators.

E. Control panel/connections: Unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit a single-point high voltage power supply connection.

F. Evaporative Cooling Module: Media holder and sump pan shall be fabricated of stainless steel and shall include 12” thick GLASdek evaporative media. Gutter and sump shall be sized to supply the system with enough water to operate at its maximum flow rate and not overflow when the system is shut down. Cooling module shall be equipped with a circulating pump.

G. Fill and drain valves are to be provided by the temperature control contractor (see sequence of operation).

H. Motorized Intake Dampers: Motorized damper of low leakage type shall be factory installed.

I. Motorized Recirculating Air Damper (when applicable): Designed to permit 100% recirculation of return air shall be factory installed. Damper shall be controlled by external 2-10 Vdc signal.

J. Seismic curb shall be provided.

K. Service receptacle: 120 volt GFCI service outlet shall be factory provided and installed by the Contractor in a location designated by the Engineer.

2.4 BLOWER

A. Blower Section Construction: Belt drive motor and blower shall be assembled onto a minimum 14 gauge galvanized steel platform and must have neoprene vibration isolation devices, minimum of 1-1/8 inches thick.

B. Blower Assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Centrifugal Blower Housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.

D. Forward Curved Fan Wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow, mechanically attached to shaft with set screws.

E. Blower Section Motor Source Quality Control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210 ‘Laboratory Methods of Testing Fans for Rating’.

2.5 MOTORS

A. Blower motors shall be NEMA Premium. Compliance with EPAct minimum energy efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy duty, permanently lubricated type, and shall be furnished for the specified voltage, phase, and enclosure type. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast type, keyed, and fully secured to the fan wheel and motor shafts. Electric motors shall be supplied with an adjustable drive pulley.

B. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors.

C. Also see Specification Section 230500 (Basic Materials and Methods for HVAC).

2.6 UNIT CONTROLS

A. The unit shall be constructed such that it can function as a stand-alone heating and cooling system controlled by the direct digital control system.

B. Control Devices:

1. Remote Thermostat: By temperature control contractor (see sequence of operation).
2. Smoke detectors, located in supply air, shall stop fans when the presence of smoke is detected.
3. Supply Air Temperature Control: Operates gas valve to maintain discharge air temperature with factory mounted sensor in blower outlet.
4. Burner Control: Two or four steps of control using one or two burner sections in series.

2.7 FILTERS

A. Units shall have 2" thick MERV 8 disposable pleated filters located in the outdoor air intake that shall be accessible from the exterior of the unit.

2.8 DAMPERS

A. Outdoor Air Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless steel jamb seals, having a maximum leakage of 10 cfm/sf. of damper area, at a differential pressure of 2 inches w.g. The damper operator shall be direct coupled, electronic, with spring return or fully modulating as required by the sequence of operation.

2.9 DIRECT EVAPORATIVE COOLING

A. Provide a direct evaporative cooling section equipped with 12” thick GLASdek media.

B. Provide a water filter for each evaporative cooler. Water filters shall be Axiom Model SPF-10, or approved equal.

C. See Specification Section 232500 (Chemical Treatment) for required chemicals.

2.10 INDIRECT FIRED NATURAL GAS BURNER

A. Description: Factory assembled, piped, and wired, complying with ANSI Z21.47 ‘Gas-Fired Central Furnaces’ and with NFPA 54 ‘National Fuel Gas Code’.

1. CSA Approval: Designed and certified by and bearing the CSA label.
2. Burners: Stainless steel.
3. Gas Control Valve: Modulating.
4. Fuel: Natural Gas.
5. Minimum Combustion Efficiency: 80 percent.
6. Ignition: Electronically controlled electric spark with flame sensor.
7. High Altitude Model: For 4500 ft elevation.

B. Venting: Gravity vented.

C. Combustion Air Intake: Separate combustion air intake and vent terminal assembly.

D. Heat Exchanger: Four pass tubular heat exchanger, constructed of Type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly (welded connections are not acceptable). Heat exchanger tubes shall be supported by a minimum of two fabricated assemblies that support the tubes and also permit expansion and contraction of the tubes. Heat exchanger shall be encased in a weather-tight metal housing with intake air vents. Provide a large metal lift-off or hinged door to provide easy access to the enclosed vest plate, control circuitry, gas train, burner assembly, and exhaust blower.

E. Heat Exchanger Drain Pan: Stainless steel.

F. Safety Controls:
   1. Vent Flow Verification: Differential pressure switch to verify open vent.
   2. Control Transformer: 24 volt.
   3. High Limit: Thermal switch or fuse to stop burner.
   4. Gas Train: Regulated, redundant, 24 volt gas valve assembly containing a pilot solenoid valve, electronic modulating temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff, all in one body.
   5. Purge-period timer shall automatically delay burner ignition and bypass low limit control.
   6. Gas Manifold: Safety switches and controls complying with ANSI standards and with FM Global.
   7. Airflow Proving Switch: Differential pressure switch to sense adequate airflow before energizing pilot.
   8. Automatic Reset High Limit Control Device: Stops burner and closes main gas valve if the high-limit temperature is exceeded.
   9. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and then back on.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Unit Support: Install heating and ventilating unit level on structural curbs. Coordinate wall penetrations and flashings with wall construction. Secure units to structural support with anchor bolts.

B. Adjust initial temperature setpoints, and set field adjustable switches and circuit breaker trip ranges as indicated.

3.2 CONNECTIONS

A. The drawings indicate general arrangement of piping, fittings, and specialties.

B. Gas Piping: Comply with requirements in 221600 (Facility Natural Gas Systems). Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Make final connections of gas piping to unit with corrugated, stainless-steel tubing flexible connectors complying with ANSI LC 1/CSA 6.26 equipment connections.

C. Drains: Comply with the requirements in Division 22 for traps and accessories on piping connections to condensate drain pans under condensing heat exchangers.

D. Where installing piping adjacent to heating and ventilating units, allow space for service and maintenance.

E. Duct Connections: Connect supply and return ducts to indirect-fired heating and ventilating units with flexible duct connectors. Comply with requirements in Section 233300 (HVAC Ductwork Accessories) for flexible duct connectors.

F. Ground equipment in accordance with the requirements listed in Division 26.

G. Connect wiring equipment in accordance with the requirements listed in Division 26.

3.3 FIELD QUALITY CONTROL

A. Perform start-up tests and operational verification with the assistance of a factory authorized service representative.

B. Prepare test and inspection reports.

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/Engineer. 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

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 89 00 - ELECTRIC HEATERS

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) are hereby made a part of this section.

1.2 WORK INCLUDED

A. Types of units specified in this section include the following:

Electric Wall Heaters
Electric Unit Heaters

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of material listed in this section.

PART 2 - PRODUCTS

2.1 ELECTRIC WALL HEATERS

A. Provide electric wall heaters in locations as indicated and with capacities, style, and accessories as scheduled. Electric wall heaters shall be UL listed.

B. Cabinet: Heavy gauge galvanized steel with beige enamel finish.

C. Heating Element: Steel sheath with aluminum fins.

D. Thermostat: Built-in and adjustable between 40°F and 70°F.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electric wall heaters which may be incorporated in the work include the following, or equal:

Q-Mark
Modine

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which terminal units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the 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.

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, fixtures, 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 99 00 - GROUND LOOP PIPING SYSTEM

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) are hereby made a part of this section.

1.2 WORK INCLUDED

A. HDPE pipe and heat exchangers used for geo-exchange heat pump ground heat exchanger installations.

1.3 RELATED SECTIONS AND REQUIREMENTS

A. Section 23 99 10 (Ground Loop Pressure and Leak Testing)

B. Section 23 99 20 (Ground Loop Flushing and Purging)

C. Section 23 99 99 (Global Positioning Utility Location Instructions)

D. The Contractor shall comply with all requirements of the National Pollutant Discharge Elimination System (NPDES) for this site.

1.4 REFERENCES

A. ASTM 01683-98, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

B. ASTM 02447-99, Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

C. ASTM 02513-99, Standard Specification for Thermoplastics Gas Pressure Pipe, Tubing and Fittings.

D. ASTM 02657-97, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.

E. ASTM 02683-98, Standard Specification for Socket Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

F. ASTM 02774-94, Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

G. ASTM D2837-98a, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

H. ASTM D3035-95, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

I. ASTM D3261-97, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

J. ASTM D3350-98A, Standard Specification for Polyethylene Plastics Pipe and Fitting Materials.

K. ASTM F714-97, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

L. ASTM F892-95, Standard Specification for Polyethylene Corrugated Pipe with Smooth Interior and Fittings.

M. ASTM F905-96, Standard Practice for Qualification of Polyethylene Saddle Fusion Joints.

N. ASTM F1055-98, Standard Specification for Electrofusion Type Polyethylene Fitting for Outside Diameter Controlled Polyethylene Pipe and Tubing.

O. ASTM F1056-97, Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining of Polyethylene Pipe or Tubing and Fittings

P. ASTM 1290-98A, Standard Practice for Electro-Fusion Joining of Polyolefin Pipe and Fittings.

Q. ASTM F1668-96, Standard Guide for Construction Procedures for Buried Plastic Pipe.

R. ASTM F1759-97, Standard Practice for Design of High Density Polyethylene Manholes for Subsurface Applications.

S. IGSHPA Manual 2000, Grouting of Vertical Geothermal Heat Pump Systems; Engineering Design and Field Procedures Manual.

T. IGSHPA Manual 2017, Closed Loop/Geothermal Heat Pump Systems Design and Installation Standards.

U. ANSI/CSA/IGSHPA C448 Series-16 Bi-National American–Canadian Standard (#21036)

V. 2018 Uniform Plumbing Code

W. 2018 Uniform Mechanical Code

1.5 SUBMITTALS FOR APPROVAL

A. Submit manufacturer's technical product data and installation instructions for pipe, fittings, valves, factory prefabricated U-bends, and grout.

B. Submit names and certificates of successful completion of training for the fusion personnel that will be on site.

C. Submit manufacturer's technical data on fusion machines to be used in joining the pipe and fittings.

D. Submit grout installation procedure, including: When grouting will occur in sequence of installation, method for placing tremie pipe at the bottom of the borehole, diameter of tremie pipe used, method for calculating amount of grout placed in each borehole, and any other information relevant to the grouting procedure. Installation of grout shall not be commenced until this information has been submitted and approved by the Engineer. Also include this information in the operating and maintenance manuals.

E. Copies of pipe, grout, and fitting warranties shall also be submitted. Include warranty information in the operating and maintenance manuals.

F. Submit manufacturer's technical product data on drilling fluids expected to be used on this project. All drilling fluids to be potable water based (No Exceptions).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material description: ASTM D3350-Type III, Grade PE3608 or Grade PE4710.

B. Pipe: The pipe shall be virgin resin with an allowance for on-site Manufacturer re-processed resin. No recycled resin shall be used. All pipe and heat-fused materials shall be manufactured from a virgin polyethylene extrusion compound material in accordance with ASTM D2513, Sections 4.1 and 4.2. The material shall maintain a 1600 psi hydrostatic design basis at 73.4°F per ASTM D2837, and shall be listed in PPI TR4 as a PE3608 or PE4710 piping formulation. The material shall be a high density extrusion compound having a cell classification of PE345464C, PE345434, PE355434, or PE345534 with a UV stabilizer of C, D, or E as specified in ASTM D3350 with the following exception: This material shall exhibit zero failures (F0) When tested for a minimum of 192 hours under ASTM D1693, condition C, as required in ASTM D3350.

1. Pipe shall be manufactured to outside diameters, wall thickness, and respective tolerances as specified in ASTM D3035 or D2447. Molded Fittings (white/Drisco) shall be manufactured to dimensional specifications and requirements of (white/Drisco) ASTM D2683 for socket fittings, ASTM D3261 for butt/sidewall fittings, ASTM D2513, Section 6.10.1 for mechanical slab fittings, and ASTM F1055 for electrofusion fittings.
    a. Pipe with a diameter of 2 inches or less (nominal) shall be manufactured in accordance with ASTM D3035 with a minimum dimension ratio of 11 (based on pressure rating). Pipe manufactured with a diameter of 3 inches (nominal) and larger shall be manufactured in accordance with ASTM D3035 and ASTM F714 with a minimum dimension ratio of 15.5 (based on pressure rating). If the pipe is used in a vertical bore application it shall be manufactured in accordance with ASTM D3035 with a minimum dimension ratio of 11 (based on pressure rating).
2. Factory-shipped loop and U-bend assemblies shall be sealed and under pressure.
    a. Fittings: The geo-exchange system pipe fittings shall be molded and shall be manufactured to the dimensional specifications and requirements of ASTM D3261 for butt/sidewall fittings. The material used in the manufacturing of the fitting shall be the same approved extrusion material as the connecting pipe. For fabricated fittings, a minimum 'quick-burst' strength of the fittings shall not be less than that of the pipe, nor less than four times the long-term water-rated working pressure.
    b. Purpose-designed U-bend fittings shall be used (instead of L+ street fittings) for ease of insertion. Acceptable manufacturers include: Performance Pipe, EnLink, and Centennial Plastics.

C. Joints: The approved joints are heat fusion, flanging, transition fittings, and proof-tested mechanical couplers. Fusion joints shall be made by trained and qualified construction crew staff. The butt fusion machine used to make the joints shall encompass the following features:
1. Guide rods shall be in a plane that passes through the centerline of the pipe, thus canceling the bending forces in the machine caused by the fusion forces.
2. The pipe clamps shall have the strength to 'round-up' the pipe close to the fusion joint. They must be adjustable for removal of high/low mismatch of pipe walls and clamp each piece on continuing straight centerline.
3. The pipe facing device shall be capable of rapid facing of the pipe ends to a perfectly flat surface, so when the ends are brought together, there is 100 percent plastic contact.
4. The facer may be hand or electric powered for pipe sizes up to 2 inches and electrically powered for pipe sizes up to 8 inches.
5. The facer shall have precisely machined stops to lock the facer squarely between the clamping jaws at the end of the face off.
6. The heater plate shall be electrically heated and thermostatically controlled. The surface shall be smooth with a high quality non-stick coating. The heater shall be capable of quick heat-up and maintaining a constant surface temperature in the desired temperature range even in inclement conditions. The heater plate shall be equipped with a thermometer to indicate temperature change. A surface pyrometer is used periodically to assure proper temperature. Use pipe manufacturer's recommended fusion temperature.
7. The socket fusion machine used to make the joints shall encompass the following features:
    a. An electric, thermostatically-controlled heater plate. The surface shall be smooth and free of foreign material the heating tool shall be capable of heating socket faces to the appropriate fusion temperatures as per manufacturer's recommendations.
    b. A set of metal socket faces which are dimensionally accurate according to current industry practices. The surface of the socket face that will be in direct contact with the pipe or fitting shall be smooth and coated with a high quality non-stick coating.
    c. Temperature-indicating crayons or a surface pyrometer. One temperature crayon shall be for the proper 'low' end temperature indication and another crayon shall be for indicating the 'high' end temperature. Use pipe manufacturer's recommended fusion temperature range.

d. A depth gauge that is sized according to pipe diameter and corresponding fusion fitting socket depth. The depth gauge shall be used to locate the cold ring the proper distance from the pipe end.

e. A metal locking cold ring clamp which supplies support for the entire circumference of the piping material. Cold ring shall have the ability to keep the pipe end round. The cold ring shall be used to limit the pipe depth entry into the socket face and fusion fitting socket.

f. A timing device that emits an audible tone and a timing light on one second intervals. Timer shall be used to determine proper heat cycle for the pipe and fitting. Use pipe manufacturer's recommended heating times.

g. A number of clean, dry, 100 percent cotton rags used to clean the socket heater faces after each fusion application. Rags shall be free of any cleaning solvents, grease, or dirt.

8. Install piping in accordance with manufacturer's written instructions and ASTM D2774. The pipe and fittings must be joined using the butt, socket, electrofusion, or saddle fusion process. No other method is acceptable. The vertical loop take-off tee fittings may be made using tees or the saddle fusion process on header piping 1.25 inch and above. Exercise extreme caution to completely remove the cutout on saddle tees. Bell reductions shall be used at all pipe reductions to eliminate trapped air.

9. Use reducing socket tees when fabricating socket type reducing headers. Consult with manufacturer for available fittings and fabricated headers.

10. Avoid sharp bends in piping. Consult pipe manufacturer for minimum bend radius. Install elbow fittings for bends which require tighter radii than manufacturer recommends. Use only continuous pipe in sharp bends.

D. Marking:

1. Each pipe shall be permanently indent marked with the manufacturer's name, nominal size, pressure rating, relevant ASTM standards, cell classification number and date of manufacture.

2. Each fitting shall be identified with the manufacturer's name, nominal size, pressure rating, relevant ASTM standards and date of manufacturer.

3. Each pipe and factory-fitted ‘U-bend’ vertical heat exchanger shall be permanently indent marked with distance in feet or meters from the U-bend tip, with marking every two feet or one meter.

4. Packaging, handling, and storage: the pipe and fittings shall be packaged, handled and stored under pressure in accordance with the approved manufacturer's general guidance and recommendations.

E. Table of Water Pressure Ratings at 73.4°F for DR-PR PE3608 or PE4710 Plastic Pipe:

Dimension Ratio	Pressure Rating
11	160 psi
15.5	110 psi

F. Thermally Enhanced Grout

1. Grout Type: Grouting material shall be a thermally enhanced grout product by Black Hills Bentonite, Baroid, or approved equal. The thermal enhancement compound (high grade silica sand) shall also be specified and supplied by the developer and supplier of the bentonite base material.
2. Grout Submittals: The successful bidder shall provide submittals on the grout, grout equipment, and procedures for review and approval by the Engineer prior to beginning any work. The grout shall also be NSF/ANSI Standard 60 certified.
3. Grout Mixing: The grout shall be mixed by using a high sheer grout mixer. The mixed grout shall have a minimum specific gravity of 1.6 or greater and a density of 14 lbs/gallon or greater.
4. Sand: The sand shall be of a high silica (quartz) type with a 50/70 mesh size and have a silica (quartz) content greater than or equal to 99%.
5. Grout Placement: Grout material shall be pressure pumped through a 1-1/4 inch or 1-1/2 inch inside diameter tremie pipe and placed in the bore column from the bottom to the top (No Exceptions). The grouting process shall conform to the manufacturer's instructions and to the ‘Grouting for Vertical Geothermal Heat Pump Systems - Engineering Design and Field Procedures Manual’ as published by the IGSHPA, Oklahoma State University, 2000. The completed grouted surface shall be placed at ground level to ensure complete fill of the bore column.
6. Grout Thermal Conductivity: The thermal conductivity of the site mixed grouting compound must meet or exceed the minimum required value called for on the drawings as determined when tested in accordance to ASTM D5334 ‘Standard Test Method for Determination of Thermal Conductivity of Soils and Soft Rock by Thermal Needle Probe Procedure’ per International Ground Source Heat Pump Association (IGSHPA) Standard 2b.1.2.1. The reported thermal conductivity value shall be verified by the manufacturer in a laboratory which has a minimum of 5 years of experience in measuring thermal conductivity using this method. A copy of each verification report shall be submitted to the Engineer upon receipt and shall also be included in the operating and maintenance manual. Verification reports provided at the end of construction are not acceptable. Also see Part 3 - Execution for additional information and requirements.
7. Grout Permeability: The grout mixture shall also have a maximum permeability rate of less than 1.0 x 10-7 cm/s as determined by using ASTM D5084 ‘Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C - Test With Increasing Tail Water Level’ per IGSHPA Standard 2b.1.2.2, with a 5 psi confinement pressure (to simulate an approximate sample depth of 5 feet).

2.2 SOURCE QUALITY CONTROL

A. Obtain pipe and fittings from compatible manufacturers.

B. The pipe and fittings manufacturer shall have a functional quality assurance/quality control program in place. Such QA/QC programs shall deal with quality and workmanship, QA verification, QA rejection, and have QA record retention systems in place.

C. The grout manufacturer shall approve the sand quality to achieve the thermal conductivity published in submittal.

PART 3 - EXECUTION

3.1 RECORDKEEPING

A. A weekly summary report of the grouting and drilling operation must be provided electronically to the Architect/Engineer or their representative for the cumulative drilled boreholes by Thursday of each week. This report shall include, at minimum, number of boreholes drilled to date, location of boreholes drilled, depth of each borehole, emplaced U-bend in each borehole, units of grout per borehole, circuit/subfield headering progress, and testing results. The borehole naming convention has been provided in the drawings.

B. Weekly reports must be current prior to each pay request or payment may be withheld.

C. The Contractor shall maintain current drilling records on the site at all times that show:
   1. Date, borehole number, circuit number, location, total depth, diameter, and time to drill for all bore holes.
   2. Time, depth, and results of any mud tests.
   3. All drilling fluid materials added to the system.
   4. Any noticeable variations in lithology.

D. The Contractor shall maintain current grout records on the site at all times that show:
   1. Time and date of grouting for all boreholes.
   2. Time, date and results of any grout tests.
   3. Grout tremie depth for each borehole grouted.
   4. Density and volume of grout used on each borehole.

E. The grout records shall be submitted in writing as part of the weekly summary report noted above for review and approval by the Engineer.

F. Engineer reserves the right to require a third party (GRTI or equal) thermal conductivity test on any boreholes that do not appear to be grouted properly. Cost for the thermal conductivity test(s) shall be borne by the Contractor.

3.2 INSTALLATION

A. Safety: The Contractor shall comply with all federal, state, and local governmental orders, rules, and regulations governing environmental issues. Such issues may include, but not be limited to, handling and disposal of hazardous materials, hazardous/special/solid wastes, chemical and petroleum product storage, spill prevention, and spill response. The Contractor shall comply with any other directions regarding environmental issues as specified by the owner in these contract documents or otherwise designated by the Owner.

B. Storage: The Contractor shall store his equipment and materials in areas to be designated by the Owner, and shall be fully responsible for the adequate protection of all items stored by the Contractor. In addition to any other requirements as to storage in the specifications and contract documents, the Contractor shall develop procedures and methods for storage of all materials and equipment which are to be installed by the Contractor. These procedures and methods shall prevent the intermixing, intermingling, contamination, undue straining or damage of any kind to the materials and equipment under the jurisdiction of the Contractor. The Contractor shall submit such procedures and methods for materials and equipment storage to the Engineer for review and approval not more than ten days after notification of award of the contract. After approval by the Engineer, the contractor shall adhere to the provisions of the procedures and methods in all respects.

C. Install piping system per ASTM D2774 and IGSHPA guidelines. Join pipe and fittings by approved methods described above and by certified personnel who have been approved according to the submittals provided by this Contractor. Protect all pipe and fittings from animals or debris at all times. Grout with approved material and following IGSHPA guidelines. The grouting process shall conform to the manufacturer's instructions and to 'Grouting for Vertical Geothermal Heat Pump Systems, Engineering Design and Field Procedures Manual' as published by the IGSHPA, Oklahoma State University, 2000 Edition.

D. All vertical loop assemblies shall extend to the bottom of the borehole as close as practical. Variations of more than 10 feet shall be approved in writing by the Engineer.

E. All ground loop pipe ends shall be sealed with a water tight cap unless the Contractor is currently working on the open section. This shall include all stockpiled material not yet used in the system. Fusion caps, fusion crimping, test caps, or plastic caps held in place with tape are the only sealing methods allowed without prior written approval. Duct tape alone is not considered acceptable.

F. All horizontal piping shall be installed in accordance with the engineering drawings. All large and/or sharp rocks and foreign objects shall be removed from contact with the pipe. The trench shall be backfilled and compacted in accordance with the appropriate 'Earthwork' specifications for this project. Provided that it is approved by the Civil Engineer, native material may be acceptable for this project. If soil conditions are not conducive to eliminating pipe contact with large or sharp rocks or is not approved for use by the Engineer, approved bedding material shall be imported and used to comply with this section. Imported bedding material shall be classified as 'reject sand'. Coordination and emplacement of the imported material shall remain the responsibility of the Contractor.

G. All penetrations through building walls shall be sealed with a flexible and watertight material. Mechanical sealing devices are acceptable if they provide a watertight seal and permit expansion and contraction of the HDPE piping. The sealing product shall be as manufactured by Link-Seal, or approved equal.

H. All header manifolds shall be constructed to IGSHPA standards and design criteria for 'Long Headers' to facilitate equivalent fluid flow, minimum pressure drop, and air removal during purging.

I. Pipe supports
   1. Space pipe supports per applicable manufacturer's instructions, remove sharp edges and burrs of hanger parts which contact pipe.
   2. Do not rigidly clamp or force pipe into position by means of hangers.
   3. Support vertical pipe with riser clamps. Restrict side motion by means of oversize U-bolts.

J. Detectable Underground Warning Tape
   1. The Contractor shall mark all horizontal runs with detectable underground warning tape. See Specification Section 23 05 00 (Basic Materials and Methods for HVAC) Section 2.21 (Detectable Underground Warning Tape). Splices shall be avoided whenever possible, but if required, splices shall be made using corrosion-proof wire connectors rated for direct burial and shall be made in a manner that prevents separation of the wires.
   2. Extend underground warning tape from the farthest end of each circuit and terminate them in the mechanical room.

K. Trenching shall be done according to OSHA regulations and in a safe manner.

L. Backfilling of Trenches
   1. Backfilling of trenches shall comply with the Earthwork Section.

M. Spoils/Cuttings:
   1. Spoils may be spread across the rough grade of the property as space permits. Excess spoils are to be removed from construction area. Coordinate a disposal location with General Contractor.

N. Drilling

1. Drill cuttings, spoils, and header excess shall be removed from the site by this Contractor, and the disposal of the above is to be done under the requirements of the local code authority having jurisdiction. Any contaminants encountered by the Contractor during installation of the ground heat exchanger shall be promptly brought to the attention of the Engineer. All drilling fluids shall be air or potable water based and all additives MSDS information shall be submitted to Engineer before drilling, with copies available at the job site for inspection. Reclaimed water or effluent is not permitted to be used for drilling. Free liquids may be evaporated before disposal by prior agreement of the Owner, Contractor, Engineer, and Environmental Quality Agency.
   a. Drilling cuttings, spoils, and fluids shall be contained on site by use of tank or mud pit. No fluids shall be allowed to run into street, sidewalks or public areas. This phase must also comply with storm water control plan for this site.
   b. If a borehole is required to be abandoned for any reason, the borehole shall be capped and sealed pursuant to IGSHPA abandonment procedures, including criteria of a water-bearing zone if applicable. The Contractor shall notify the Engineer at the time of abandonment and shall include this information in the final as-built documentation.

   a) Any bore hole diameter given on the drawings or in the specifications is for reference only. Installed bore hole diameter is subject to contractor means and methods and shall be clearly documented for each bore hole on the drilling records. It is the contractor's responsibility to install the system in a way that meets the requirements of the contract documents and is satisfactory for the unique needs of the project.

   c. If the driller feels that formation would dictate a borehole filter cake thicker than 1/16" promptly notify the Engineer.
   d. Depth and spacing of boreholes shall be as noted on the drawings.
   e. Once a hole is drilled to total depth and looped/pressure tested, grout from bottom to within 6' of finished grade. Grouting must occur from the bottom of the borehole to the top with the tremie pipe taken down to the bottom of the borehole and any additional depth drilled. No exceptions to this grout installation method will be allowed. Top off with more grout should settling occur.
   f. Remove temporary casing, if used. It may not be left in place. Notify the Engineer if temporary casing cannot be removed.

O. Grouting

1. All emplaced U-bend assemblies shall be completely filled with water or air prior to beginning the grouting process. Pressure caps with a pressure rating greater than 100 psig shall be used on the emplaced U-bend assembly and 50 psig of air or water pressure shall be placed on the U-bend assembly. Hold pressure on the system for a minimum of one hour after the grouting operation is complete to permit the grout to set.
2. Grout shall be placed by pressure pumping through a 1.25" minimum tremie pipe within 24 hours of drilling each borehole. The tremie pipe shall be lowered to the bottom of the zone being grouted and raised slowly as the material is introduced, keeping the end submerged in the grout. The tremie may be temporarily tied to the bottom of the U-bend loop assembly to carry it to the bottom of the borehole. All grout shall be emplaced to the maximum extent possible in a single continuous operation upward from the bottom of the borehole. The tremie pipe shall be continuously submerged in the grout until the zone to be grouted or filled is complete. All completed boreholes must be topped off to the surface at all times to comply with State Regulations.
3. All boreholes shall be completely filled with grout. Grout levels must be maintained to prevent surface borehole collapse and/or surface contamination from entering the borehole. Boreholes that are not completely filled with grout must be identified on the weekly report.

4. The Contractor shall collect grout samples and submit samples to the grout manufacturer for laboratory testing of thermal conductivity. The number of samples shall be as indicated in the associated schedule on the drawings. Samples shall be sent to the lab within two days of collection. The lab shall forward test results directly to the Architect/Engineer and the Owner's Representative in a timely manner. Lab results shall also be submitted with the weekly reports. Samples and results shall include project name, borehole identification, date, and time. Lab results not submitted until the end of the project will not be accepted. All testing costs are to be borne by the Contractor.
5. In the event that the analysis indicates a thermal conductivity value below the minimum specified value, corrective action shall be taken to increase the thermal conductivity value back to the minimum specified requirement. A written report shall be submitted defining the corrective action to be taken for review and approval by the Architect/Engineer. Corrective action shall commence after the corrective action report has been approved.
6. The Architect/Engineer or Owner's Representative may collect additional grout samples at their discretion. Testing shall follow the procedure outlined above and shall be at the Contractor's expense.

P. Disposal of Existing Materials:
   1. Excess clean soils shall be removed from site.
   2. Surface conditions:
      a. Compact, clean, rock free soil in header trenches to 95% of original density to within one foot of final grade.
      b. All parts of the ground heat exchanger shall be inspected, flushed, and purged of all debris and air, and pressure tested prior to covering or backfilling any of the vertical boreholes or horizontal trenched piping. Pressure testing logs shall be submitted for review and approval, and shall be included in Operation and Maintenance manual. Pressure testing of at least one circuit shall be witnessed by the Engineer and/or the Commissioning Agent. Provide minimum 5 working days' notice.
      c. Call Before You Dig: The Call Before You Dig number is 811. The Contractor is responsible for contacting this agency a minimum of 48 hours prior to commencement of any subsurface work. All subsurface work shall be coordinated with Call Before You Dig.

Q. Testing:
   1. Grout testing shall be completed in accordance with the 'Grouting" section of this specification.
   2. Conduct flow test on all circuits and completed fields and submit results to Engineer for review and approval. Flow tests shall show circuit number, flow rate and pressure drop measured at that flow rate.
   3. Conduct pressure tests on each loop, completed circuits (horizontal manifolds) and completed field(s); and submit results to Engineer for review and approval.
   4. Before connection header trenches are backfilled, the assembled loop system shall be pressure tested with water at 100 psi for 15 minutes, in which time there shall not be observed leaks. Flow and pressure loss testing shall be performed and the actual flow rates and pressure drops shall be compared to the calculated design values. If actual flow rate or pressure drop values differ from calculated design values by more than 10 percent, the cause shall be identified and corrective action taken.
   5. Testing shall be done in accordance with the 2018 UMC and 2016 IGSHPA Manuals. See Section 239910 (Ground Loop Pressure and Leak Testing) for additional requirements.

3.3 REPAIR/RESTORATION

A. Repair leaks found when testing by cutting the damaged section and replacing it with an approved socket or butt-fused piece (or other pre-approved mechanical connector).

3.4 FIELD QUALITY CONTROL

A. Pressure/Leak Test: Per manufacturer's instruction:
   1. U-bend assembly before insertion.
   2. U-bend assembly before circuit header installation.
   3. Each circuit.
   4. System at the interior pump manifold.
   5. See Section 239910 (Ground Loop Pressure and Leak Testing) for additional requirements.

3.5 CLEANING

A. Flush piping system with potable water at 3 FPS and observe for free flow. The contractor shall ensure there is not partial kinking or crimping either in the header or in the U-bend. All pressure drops for each circuit shall be recorded and within 5% of each other at this flow rate. See flushing and purging requirements for more information.

B. Remove material or obstructions that interfere with fill flow.

C. Adjust piping to remove kinks or crimping in piping, U-bends, and header system.

D. The site shall be compacted and returned to rough grade; and approved by the GC.

3.6 WARRANTY

A. All pipe and fittings shall have a minimum warranty of 25 years from defects.

B. The Contractor shall provide a minimum warranty of 5 years for parts and labor on this scope of work.

3.7 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.

3.8 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with the indicated requirements.

3.9 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 99 10 - GROUND LOOP PRESSURE AND LEAK TESTING

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) are hereby made a part of this section.

1.2 WORK INCLUDED:

A. Pressure and leak testing of ground loop piping systems.

B. See Specification Section 23920 (Ground Loop Flushing and Purging) for additional requirements.

1.3 REFERENCES

A. 2018 Uniform Plumbing Code

B. 2018 Uniform Mechanical Code

1.4 DEFINITIONS

A. Dry Oil Free Compressed Air (DCA): Compressed air, oil free, with a -40° to -75°F dew point at atmospheric pressure.

1.5 SUBMITTALS FOR APPROVAL

A. Test records for each piping system prepared during pressure and leak testing, indicating date of test, identification of piping system tested, test media, test pressure, and certification of results.

1.6 QUALITY ASSURANCE

A. Prepare test records for each system during pressure and leak testing, including date of test, identification of piping system tested, test media, test pressure, and certification of results. Individual test records shall be retained in addition to certification that piping has satisfactorily passed pressure and leak testing.

1.7 SEQUENCING

A. Perform testing after completion of installation, and according to the following listing:

1. For HDPE pipe, perform pressure testing with the pipe on the spool before installation (if the pipe has not been shipped under air pressure).
2. Perform pressure testing after placement of the U-bend in the ground.
3. Perform pressure testing after the header connections have been completed.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Calibration Date: Maximum of 12 months prior to test.

B. Use test equipment with label indicating serial number, calibration date, and name of firm or laboratory performing calibration.

C. Include calibration records in the submittal package.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine system installation for compliance with drawings and specifications.

B. Ensure that all pressure relief valves have been inspected and set at the required pressure.

C. Ensure that all rupture discs have been properly installed.

D. Examine the system for leaks at any valves, connections, and joints.

E. Examine the piping system for defective, broken, or cracked piping and fittings.

3.2 PREPARATION

A. Isolate or replace with spool pieces vessels, pumps, instruments, controls, safety valves, relief valves, and any other equipment items rated for pressures that are below the test pressure.

B. Provide temporary over-pressurization protection devices between the pressure source and the test equipment.

1. For Class A (Pneumatic Test) set temporary over-pressurization protection devices at the test pressure plus the lesser of 50 psi or 10% of the test pressure.
2. For Class B (Hydrostatic Test) set temporary over-pressurization protection devices at 130% of the test pressure.

C. Disconnect or isolate by blind flanges or other means any equipment that is not to be tested. Valves may be used provided the valves are rated for the test pressures.

D. Maintain joints, including welds and bonds, uninsulated and exposed for examination during testing. Joints previously tested may be insulated or covered after obtaining approval from the Architect/Engineer.

E. Provide additional temporary supports as necessary to support test media (when weight of test media exceeds weight of design system fluid).

F. Clear the test area of personnel not involved with the pressure testing.

3.3 REPAIR/RESTORATION

A. Repair leaks and re-test repaired joints until test requirements have been satisfied.

3.4 CLASS B HYDROSTATIC TEST

A. Special Requirements for Water Systems

1. Test systems conveying potable water with dedicated and controlled test equipment that is used only on systems conveying potable water.
2. Equipment includes pumps, pressure gauges, hoses, pipes, caps, and other test equipment that contacts potable water.

B. Test Pressure: 150% of the design pressure or 100 psi, whichever is greater.

C. Test Procedure

1. Pressurize the system to the test pressure.
2. Maintain the test pressure for a minimum 30 minutes without a drop in pressure.
3. Examine valves, flanges, welds, joints, and connections for leaks.
4. Drain the test media from system.
5. Reconnect all instruments and equipment.
6. Refill the system with test media, pressurize to maximum operating pressure, and examine valves, flanges, welds, joints, and connections for leaks.

D. Acceptance Criteria: No leakage is permitted at compression fittings or threaded joints. No leakage is acceptable at valves and gaskets.

E. Test media for ground loop pipe testing shall be potable water.

3.5 DEMONSTRATION

A. Pressure testing shall be witnessed by the commissioning agent.

3.6 TEST PRESSURE TOLERANCE

A. Use a test pressure tolerance of +5 psig and -0 psig.

3.7 HIGH DENSITY POLYETHYLENE PIPING TESTING

A. Preliminary Work: Thoroughly clean all pipe and tubing prior to installation. During installation prevent foreign matter from entering systems. Remove any observed obstructions from the piping systems.

B. Flushing, Purging, Pressure and Flow Testing:

1. All fusion joints and loops lengths shall be checked to verify that no leaks have occurred in shipping or in fusion joining.
2. All loops shall be pressure tested before installation, and all horizontal components of the ground heat exchangers shall be pressure tested prior to backfilling.
3. Heat exchangers shall be tested in accordance with the HDPE Quick Test II. Do not test until every joint has set and cooled for at least 8 hours. Record trench temperature at start and finish of pressure test. Use test gauge with 1 psi increments, readable to ½ psi.
4. Cleaning: Flush systems and apparatus upon completion of pressure and miscellaneous tests. Completely open valves and flush each system with clean water, prior to chemical cleaning. Repeatedly flush at short intervals until twice the system water capacity has been flushed through. Keep strainers unplugged during cleaning operations. Remove and clean strainer screens prior to operational test.
5. Flow rates and pressure drops shall be compared to calculated values to ensure that there is no blockage or kinking of any pipe.
6. A minimum velocity of 3 ft/sec in each piping section must be maintained for a minimum of 15 minutes to remove all air. A change of more than one inch in the level of fluid in the purge pump tank during pressurization indicates that air is still trapped in the system.

END OF SECTION

SECTION 23 99 20 - GROUND LOOP FLUSHING AND PURGING

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) are hereby made a part of this section.

1.2 PUMPING UNIT

A. The flushing and purge pumping unit is to be furnished by the Ground Loop Contractor.

1.3 RESPONSIBILITIES

A. The Mechanical Contractor shall install the building piping and test the building piping system as specified herein when completed. The Mechanical Contractor shall provide the initial flush and purge of the building loop piping, and a final flush and purge of the entire building loop and ground loop system at project completion. See additional details in the following sections.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. The Ground Loop Contractor is responsible for flushing and purging the entire ground loop. The ground loop shall be flushed, purged, filled with water, and tightly sealed at the end of the ground loop installation process.

B. The ground loop flush trailer shall be capable of required gpm, and have calibrated flow meter and strainer. Flushing and purging shall be witnessed by the Commissioning Agent, Owner, and Engineer. Provide a minimum of 5 working days advance notice.

C. Flush and purge the ground loop (ground source side) as follows:
   1. All interior building loop piping shall be isolated at the headers in the mechanical room. Open any balancing valves on headers being purged.
   2. Fill and flush each header pair with clean potable water until water runs clear.
   3. Except for the pair nearest to the purge ports (1st header pair), isolate all header pairs from the ground loop.
   4. Run the purge pump to circulate the potable water until all debris and air bubbles are no longer detected in the purge barrel.
   5. Isolate the first header pair and flush and purge the second header pair per the previous step until debris and air bubbles are no longer detected. Repeat until all header pairs are properly flushed and purged of debris and air bubbles.
   6. Provide typed purge report with flow, pressure drop, and durations for each header pair.
   7. Purge the site distribution loop in a similar fashion.
   8. Provide a typed purge report with flow, pressure drop, and durations for the site distribution loop.
   9. Tightly seal the entire system and ensure that there are no leaks.

D. Fill the entire ground loop system with water.

E. The ground loop water volume shall be recorded by the Ground Loop Contractor and included in the ground loop as-built drawings and in the operating and maintenance documentation.

F. The Ground Loop Contractor shall provide a clean, flushed, and purged system (ground source side) prior to the Mechanical Contractor connecting to the building interior piping.

G. The Mechanical Contractor is responsible to fill the completed interior building loop system with water and pressurize as indicated in this section.

H. Pressurize the heat pump water system (load side) as follows:
   1. Open all isolation valves.
   2. Ensure that the purge valve is closed and pressurize the system to a minimum of 30 psi.

I. At the completion of the building piping (load side) the Mechanical Contractor shall ensure that the entire building piping system completely is cleaned and flushed and is then responsible for connecting the building loop piping to the ground loop manifold.

J. The Ground Loop Contractor shall take the necessary steps to verify a cleaned, flushed, and purged system (ground loop side) prior to the Mechanical Contractor providing chemical treatment.

K. The Mechanical Contractor shall chemically treat the water in the entire connected water system (building loop and ground loop).

3.2 LOOP FIELD

A. Filling, testing, flushing, and purging the ground loop system shall be as follows:
   1. Filling: Fill the ground loop piping system with clean potable water. The ground loop shall be isolated and shall remain isolated during filling, flushing, and testing.
   2. The ground loop and any future buildings shall not be hydraulically connected until each segment is flushed, purged, and accepted by the Architect/Engineer. Remove as much air as possible before connection of the flushing unit. Hydrostatically test the ground loop and repair any leaks.
   3. The ground loop shall be inspected and tested for leaks with a hydrostatic test at 100 psi for a minimum of 24 hours without a drop in pressure. Drain the system to repair any leaks and/or drips. No chemicals, solutions, or substances shall be added to the system to stop leaks. The entire system requires a tight seal and is designed to be a closed system with no make-up water.
   4. Flushing: The water velocities in the system shall be maintained at 3 feet per second or greater for a minimum of 30 minutes, with reverse flow in the opposite direction maintained for a minimum of an additional 30 minutes. It may be necessary to reverse the flow several times to ensure a clean system. Save all debris in sample bags for observation by the Architect/Engineer and the Commissioning Agent. Reversing the flow is intended to ensure that any debris lodged in a tight location or resting place has an opportunity to move in the opposite direction and exit the system. A calibrated flow meter, ultrasonic flow meter, or orifice flow device that is accurate within plus or minus 2% shall be utilized during the flushing and purging procedures.
   5. Flow rates shall be met and documented in order to allow for the Architect/Engineer and Commissioning Agent to provide final acceptance. Flushing is not considered purging and therefore this process shall be duplicated after all equipment is connected the circuit.
   6. Testing: Once the system has been tested for leaks and purged of debris, the ground loop piping shall be tightly sealed until after the building loop is completed. At this time, and after the building loop piping has been tested by the Mechanical Contractor, the building equipment can be permanently connected to the piping system with the indicated check valves permanently installed. Test for leaks at all building equipment and all recent connections before proceeding. At this time, the system shall be tested at 100 psi water pressure before the final purging. The Mechanical Contractor and the Ground Loop Contractor are to approve this pressure test prior to the final purge.
   7. Purging: Purging the system of air shall be accomplished using a purge unit capable of velocities of 3 ft/sec or greater. Flow shall be in the service direction and not reversed. Micro-bubbles are a result of high velocities and therefore excessive flow should be avoided. The Ground Loop Contractor shall utilize an ultrasonic flow meter to verify velocities in the building loop and in the ground loop.

8. Completing the Circuit: When the entirety of the building loop and ground loop have been tested and accepted, the isolation valves shall be opened and placed in the service position. Heat pump startup shall not proceed until the circulating pumps have been activated and tested.
9. Sealing: Upon acceptance of the final purging process by the Architect/Engineer and the Commissioning Agent, the completed system shall be sealed with 30 psi pressure. Purge valves are to be sealed using blind flanges or plugs. A tag shall be attached to the purge valves with a list of chemicals and concentration. This information shall also be included in the final operating and maintenance manual.

END OF SECTION

SECTION 23 99 99 - GLOBAL POSITIONING UTILITY LOCATION INSTRUCTIONS

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) are hereby made a part of this section.

1.2 RECORD GLOBAL POSITIONING UTILITY LOCATIONS

A. As-Built Utility Locations by Global Position System: The Contractor shall provide as-built locations and elevations for well head locations. The locations and elevations shall be tied using global positioning equipment. The tied locations shall be based on the Nevada State Plane West Zone (NAD 83/94) as determined with Real Time Kinematic (RTK) GPS observations with corrections transmitted by the Washoe County Continuous Operating Reference Station (CORS) 'Reno'. Other local survey control may be utilized if approved in writing by the Architect/Engineer and Owner.

B. Horizontal and Vertical Accuracy: Shall be +/-0.20 feet.

C. Format: The GPS information shall be provided to the Owner so that they can re-establish the tied points using global positioning equipment.

D. The tied points shall be as follows: Well Heads (location at the center of all well heads with elevation at the top.

E. Include electronic GPS location information in the final operation and maintenance manuals.

F. Include an 11x17 site plan map framed and placed under glass in the mechanical room showing the bore field head locations and numbering of bores/circuits.

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. 2018 International Building Code (IBC) Published by the International Code Council (ICC).

B. 2017 National Electrical Code (NEC) published by the National Fire Protection Association (NFPA)

C. 2018 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. 2018 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 2018 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.

B. Related Sections:
1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.
2. Section 31 20 00 - Trenching: Execution requirements for trenching required by this section.
3. Section 31 20 00 - Fill: Requirements for backfill to be placed by this section.

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-V 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 receptacle and 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'

Alternative wire sizing: Where loads shown on panel schedules are less than 80% of the breaker rating per branch circuit, contractor may perform calculations demonstrating less than 3% voltage drop and modify wire size accordingly.

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.

B. Related Sections:
1. Section 26 05 03 - Equipment Wiring Connections.
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 53 - Identification for Electrical Systems.
5. Section 26 27 16 - Electrical Cabinets and Enclosures.
6. Section 26 27 26 - Wiring Devices.
7. Section 27 05 33 - Conduits and Backboxes for Communications Systems.
8. Section 27 05 36 - Cable Trays for Communications Systems.
9. Section 28 05 28 - Conduits and Backboxes for Electronic Safety and Security.

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.

E. Welded boxes are not acceptable.

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 260573.16 "Coordination Studies" for overcurrent protective device coordination 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 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 08 10 - ELECTRICAL SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section

B. Owner's Project Requirements and Basis of Design documentation

C. ASHRAE Guideline 0-2005, The Commissioning Process.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Specification Section 01 91 13 (General Commissioning Requirements)

B. Specification Section 22 08 10 (Plumbing Systems Commissioning)

C. Specification Section 23 08 10 (HVAC Systems Commissioning)

D. All other Specification Sections in Divisions 22, 23, and 26.

1.3 REFERENCES

A. IECC

1. International Energy Conservation Code (IECC) 2018 – Section C408: Maintenance Information and System Commissioning

B. NETA:

1. ANSI/NETA 2021 Standard for Acceptance Testing Specifications

1.4 DEFINITIONS

A. Basis of Design (BOD): The documentation of design criteria and assumptions for systems, components, and methods chosen to meet the Owner's Project Requirements and applicable regulatory requirements, standards, and guidelines. The document includes narrative descriptions of the systems to be commissioned. The BOD is prepared by the Design Professionals.

B. Building Automation System (BAS): The automated building system providing control and user interaction with select building systems, such as the HVAC, domestic hot water and lighting systems. Also, often referred to as building management system (BMS), energy management system (EMS), or an energy management and control system (EMCS).

C. Commissioning (Cx): A quality-focused process to verify and document that building systems are installed and perform as intended per the OPR, BOD and design documents.

D. Commissioning Authority (CxA): An independent entity hired directly by the Owner to lead, oversee and review the completion of the commissioning process and tasks. The CxA is not

responsible for the design or construction of the project. The CxA is the authority on commissioning process, program elements and results, and assists the construction team with coordinating and completing tasks. And reviews and witnesses the completion of the process and tasks using a sampling approach.

E. General Contractor (GC): The contractor directly contracted to the Owner with overall responsibility for the project construction and all commissioning activities described herein.

F. Functional Performance Test (FPT): A test of the dynamic function, operation and control of the equipment and systems to verify system performance to the fullest extent. Systems are tested under various operating modes and control sequences including failure modes. The FPTs are performed using manual (direct observation) or monitoring methods. The FPTs can include sequence of operation tests, verification tests, performance tests, integrated systems tests, and trend analysis (monitoring). FPTs are often referred to as acceptance testing.

G. HVAC: Heating, ventilation, air conditioning.

H. Installation Verification (IV): Field verification and documentation of proper installation of system equipment, assemblies, and components, per design documents, manufacturer guidelines and industry standards. The IV process is typically complete when systems are ready for startup or operation.

I. Owner's Project Requirements (OPR): A document describing the operational and functional requirements of a project, the expectations of how the facility will be used and operated, and the equipment and system expectations and requirements, as defined by the Owner. This document provides an explanation of the ideas, concepts, goals, success criteria, and supporting information for the project.

J. Pre-Functional Check/Test (PFCT): A check or test performed on a piece of equipment or system before, during, or after the initial startup and operation, but prior to the FPT phase. The PFCT is performed to confirm, verify and document the system equipment and individual components are working properly, are controlled properly and meeting applicable performance requirements and specifications. For electrical service and distribution systems, examples include applicable visual and mechanical inspections and tests per NETA standards performed prior to system FPTs. For lighting control systems, examples include lighting control system pre-functional checks and tests to confirm all lighting control sensor, wall switch, dimmer and device settings have been programmed, tested and adjusted for occupancy, vacancy, dimming, daylight harvest control functions, pre-programmed scenes, etc., per the design sequence of operation. And other pre-functional checks to confirm the sequences of operation for each room and the entire building have been fully programmed and tested, including any global (building wide) sequences and settings for time schedules, demand respond, etc.

K. Startup: Initial starting or activating of equipment usually performed by the Trade Contractor or the Manufacturer's authorized representative, including applicable PFCTs during the startup process. For electrical systems, startup is often also referred to as energization.

L. Systems Manual: A manual that provides the operating staff the information needed to understand and optimally operate the commissioned systems. It expands upon the scope of traditional operating and maintenance documents and is compiled of multiple documents such as the final BOD, single line diagrams, and as-built controls drawings and sequences of operation.

M. TAB: Testing, Adjusting, and Balancing (TAB) work on the HVAC&R air and water systems to ensure design flow, pressure and temperature conditions are met. Performed by the TAB Trade Contractor.

N. Trade Contractor: A subcontractor who provides and installs specific building components and systems and/or provides certain services.

1.5 GENERAL COMMISSIONING DESCRIPTION

A. Commissioning is a quality-focused process for achieving, verifying and documenting that building systems are installed and perform functionally as intended according to the OPR, BOD, and the requirements of the design documents.

B. The work includes the completion and documentation of formal commissioning procedures by the GC, Trade Contractors, and the Manufacturer Representatives.

1. The GC and Trade Contractors shall provide the quality control for the installation, startup, checkout and testing of the systems. The commissioning process provides independent review and witnessing by the CxA (using a sampling approach) throughout the process and during qualitative functional performance testing, to observe and verify the implementation of the process, specific tasks and quality control efforts.
2. Refer to Section 019113, General Commissioning Requirements for summary description of the general commissioning process and requirements.
3. The Trade Contractors and the Manufacturer Representatives shall be responsible for participation in the commissioning process as outlined in this specification and Section 019113 General Commissioning Requirements.

C. Systems and equipment to be commissioned:

1. Electrical service and distribution systems, including emergency power and metering.
2. Electrical service and distribution systems, including main switchgear / switchboards, unit substations, distribution boards, panel boards, transformers, and grounding.
3. Emergency power systems, load bank connection, as applicable.
4. Central uninterruptible power supply (UPS) systems, including maintenance bypass switches and annunciator panels, as applicable.
5. Electric meters
6. Energy and water metering & sub-metering system (electric, gas & water).
7. Lighting and lighting controls, including daylighting controls.

D. Systems and equipment not included in the commissioning are listed below. Commissioning of these systems may fall under the responsibility of the Contractor and/or the Authority Having Jurisdiction (AHJ) as noted in the specifications.

1. Process systems and equipment.
2. Electrical branch circuit wiring and receptacles.
3. Fire alarm and life safety system.

4. Telecommunications / IT systems.

1.6 COMMISSIONING TEAM

A. The Commissioning Team is comprised of the following:

1. Owner and Owner's Representatives
2. Commissioning Authority (CxA).
3. Design Professionals
4. General Contractor (GC)
5. Trade Contractors responsible for systems covered in this section include:
   a. Electrical Contractor
   b. Lighting Controls Contractor or Manufacturer's Representative (if applicable)
   c. Energy & Water Metering System Specialist or Manufacturer's Representative
   d. Third-party Electrical Systems Testing Agency (if applicable)
   e. BAS Contractor (if applicable)
6. Manufacturer Representatives supplying equipment, materials, components and controls for the systems to be commissioned.

1.7 COMMISSIONING PROCESS

A. Submittal Reviews by the CxA

1. The CxA will review pertinent Trade Contractor submittals for the appropriate systems in the commissioning scope, concurrently with the Design Team and will provide review comments to the Design Team.
2. The GC shall provide a submittal log to the CxA for referencing the requested submittals to be reviewed by the CxA (for which the GC shall issue to the CxA concurrently with the submission to the Design Team). Alternatively, the GC shall include the CxA on the distribution of all Trade Contractor submittals issued to the Design Team, for systems applicable to this specification.
3. The GC shall issue the requested submittals to the CxA for review at the same time they issue the submittals to the Design Team.
4. The CxA will also use the information from the submittals to develop commissioning forms and test procedures.

B. Cx Plan and Form/Procedure Development

1. The CxA prepares a Preliminary Cx Plan either during the project final design phase or early construction phase. The Cx Plan provides guidance in the execution of the commissioning process during construction.
2. Commissioning during construction begins with a kickoff meeting conducted by the CxA where the CxA reviews the commissioning process and responsibilities with the

appropriate team members. The CxA presents the Preliminary Cx Plan and discusses the project specific requirements.

3. The GC and Trade Contractors shall submit to the CxA, for review and approval, their written procedures and "blank" forms for completing all of the required Cx pre-functional tasks including IV, Startup, and PFCT tasks prior to conducting any of these tasks. See Paragraph 1.9 for the submittal requirements for the contractor procedures and blank forms, including the content requirements for the procedures and blank forms. The project specific procedures and blank forms will be further described in the Cx Plan.
    a. IV forms are to provide field verification and documentation of proper installation of system equipment, assemblies, and components, typically completed prior to formal Startup. Where appropriate and approved by the CxA, these forms may be combined with the Startup forms.
        i. The IV forms are either supplied by the Trade Contractor and/or the Manufacturer and shall include all checklists and verification requirements from the Manufacturer's installation and operation manual (IOM).
        ii. The Trade Contractors are to verify equipment installation per the Manufacturer's guidelines and requirements, and thus are to use and complete any applicable equipment IV checklists contained in the Manufacturer's IOM, in addition to any IV forms used by the Trade Contractors to verify system, equipment and assembly installation per design and industry standards.
        iii. The IV forms may also contain any applicable design drawings, plans, details, or single line diagrams that will be field verified and signed off / checked by the Trade Contractor.
    b. The Startup procedures and forms are either supplied by the Manufacturer and/or installing Trade Contractor and shall be used to document the completion of the formal startup procedures and associated checks and verifications during the startup and initial operation. And shall include all required startup and checkout procedures from the Manufacturer's IOM.
        i. Where applicable, these forms shall include checks of the equipment internal / factory provided controls including sensors and control devices.
        ii. Where required per the design specifications, the startups shall be completed by the authorized Manufacturer's representative.
    c. PFCT procedures and forms are Trade Contractor provided written procedures and forms used to document the completion and results for the various checks and tests performed before, during, or after startup.
        i. For electrical service and distribution systems, examples include applicable visual and mechanical inspections and electrical tests per ANSI/NETA.
        ii. For lighting systems, examples include lighting control system pre-functional checks, such as occupancy sensor setting checks, individual sensor and switch tests, controls programming checks, etc.
4. The CxA reviews the procedures and blank forms for all IV, Startup and PFCT tasks, and will issue any comments, which may include additions or changes to be made by the Trade Contractor to the forms and procedures, and/or supplemental forms may be issued by the CxA, where appropriate, to improve the forms and commissioning process.

5. The CxA will develop FPT procedures and forms and provide the draft forms to the GC and Trade Contractors for review and comment.

C. Pre-Functional Activities and Tasks

1. Meetings will be conducted throughout construction with commissioning team members, as required, to plan, coordinate, and schedule commissioning activities, review documentation, and resolve Cx issues.
2. The Trade Contractors shall perform the IV, Startup and PFCT tasks for all systems and equipment (no sampling allowed), unless the contract or design documents allow for sampling of the pre-functional tests (as example, if sampling were allowed for pre-functional HVAC system duct leakage tests).
3. In general, the GC and Trade Contractors are to complete the IV prior to Startups, but where appropriate and approved by the CxA, the IV and Startup can be combined into one task.
4. The Trade Contractors shall document the completion of the IV, Startup and PFCT tasks on the IV, Startup, and PFCT forms.
5. The GC shall submit all completed IV, Startup, and PFCT forms to the CxA for review prior to conducting the FPTs.
6. The CxA will review the completed IV, Startup, and PFCT forms. The CxA will also conduct various field observations and reviews of the installation including reviews of the completed IV forms, and may witness a sample of the Startup and PFCT activities. Some witnessing of the PFCT activities may be performed as back-checks conducted by the Trade Contractor with the CxA, after PFCT forms are complete (e.g., back-checks of the BAS pre-functional checks/tests and TAB).
7. The Trade Contractor shall resolve any IV, Startup and PFCT issues or results deemed unacceptable by the CxA.
8. The CxA may create System Readiness Checklists to track the status and completion of the IV, IV, Startup, and PFCT forms, including review by the CxA, prior to the FPTs.

D. Functional Performance Testing

1. FPTs are to test the dynamic function, performance and control of the equipment and systems under various modes of operation. These tests verify the correct implementation of the sequences of operation and the system performance meets the design criteria. The FPTs are performed using manual (direct observation) or monitoring methods. FPTs include the following types of tests, where applicable:
    a. Sequence of Operation Tests
        i. Sequence of operation tests are witnessed by the CxA for each unique sequence of operation but may not necessarily be repeated across identical systems, equipment or spaces, if the contractor has verified the same programmed sequence of operation code (as tested) has been programmed across multiple identical systems, equipment or spaces, based sample verification tests witnessed by the CxA.

ii. Testing certain critical or important sequences with a higher sample rate across identical systems, equipment or spaces, beyond the individual sequence of operation tests may be required and will be determined by the CxA.

b. Verification Tests.

i. Verification tests are often less detailed tests than the sequence of operation tests and are typically witnessed by the CxA at a higher sample rate.

ii. Examples of verification tests include: a) verifying the programmed sequence of operation code and control settings are the same as the as-tested code per the sequence of operation tests, b) verifying the alarm points are configured per the sequence of operation tests (without having to repeat the actual sequence tests), c) testing the function of individual room lighting control sensors, switches and devices.

c. Performance Tests.

i. Performance tests are to be performed after the sequence of operation and verifications tests, and are focused on testing and verifying performance.

ii. Examples include: a) measuring and testing indoor light level, and b) testing the performance of an emergency power generator using a load bank, to verify the power output for a prescribed startup condition, part and full load operating conditions, and transient load step conditions.

d. Integrated Systems Tests.

i. Integrated systems tests verify the operation and performance of multiple systems together operating in a coordinated, stable and efficient manner. Often the integrated systems tests are combined with the performance tests.

ii. An example is a whole building emergency power integrated systems tests, to test the combined operation of the transfer switches and emergency power generators, as well as the electrical service and distribution systems, lighting, etc., and other building systems during an actual loss of normal utility power and then upon return of normal power.

iii. Integrated systems tests may also be conducted via analysis of BAS or lighting control system trend data.

2. The CxA will develop FPT forms that contain:

a. Specific step-by-step procedures to execute the test in a clear, sequential and repeatable format, including any control system point value or setpoint overrides required to simulate a test condition or sequence mode.

b. The expected system response and acceptance criteria of proper performance with a Yes/No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.

c. A section for recording actual system response, notes and comments.

3. Execution of the FPTs:

a. Once the IV, Startup and PFCT forms are complete, the Trade Contractors shall execute the FPTs, with the FPTs witnessed by the CxA, unless otherwise by the CxA.

b. The GC and Trade Contractors are responsible for ensuring all systems are installed, operating and performing per the requirements of the contract and design documents, and are ready for the FPTs.

c. The Trade Contractors shall determine what level of pre-testing is appropriate in order to prepare for the CxA witnessed FPTs.

d. A percent sampling approach may be used for executing the FPTs of identical systems and equipment. The approximate system sampling rates for the manual (direct observation) FPTs are defined in Part 3 of this specification and/or in the Cx Plan.

e. The acceptance criteria for the FPT sampling shall be zero, meaning, any FPTs that do not pass shall require the Trade Contractor to resolve the issue for all applicable systems and equipment (even those specifically not in the original sample) and new sample rates selected for a re-test executed by the Trade Contractor and witnessed by the CxA. The CxA shall deem the FPTs acceptable after all FPTs, including re-tests, have passed and resolution of all issues completed.

f. The CxA will document the results of all FPTs on the associated FPT forms created by the CxA, unless indicated otherwise on the FPTs.

g. The Cx Plan will define any required seasonal or deferred testing.

E. Cx Issues and Recommendations

1. Throughout the process, the CxA records Cx issues, observations and recommendations on the Cx Issues Log and distributes the Cx Issues Log to the team.

2. The Cx Issues Log requires contributions and input from each of the Cx team members and as such everyone on the Cx Team has a responsibility to update the log via the agreed upon mechanism.

3. The software program and format for the Cx Issues Log will be provided by the CxA or another software program and format may be used as approved by the CxA.

4. The GC and Trade Contractors shall correct the Cx issues and recheck or retest the system(s) without delay at no additional cost to the Owner.

5. The CxA will verify the completion of the issues and recommendations via onsite reviews or witnessed retests, documentation or photographs provided by the GC and Trade Contractors, or based on information and communications provided by the GC and Trade Contractors.

F. Training Verification

1. The GC shall submit a comprehensive Training Plan (with specific training agendas provided by the Trade Contractors) for review by the Design Professionals, CxA and Owner, prior to conducting any training.

2. The Training Plan shall meet the specific requirements in the contract documents and specifications for each applicable system to be commissioned, and may include both operations and maintenance (O&M) staff training and building occupant training.

3. The GC shall coordinate with the Owner and/or Owner's Representatives, as needed, regarding any specific requirements for occupant training.

4. The CxA will verify completion of the training by witnessing some training sessions and receiving a copy of all training class sign-in sheets and any training materials / handouts, to be provided by the GC or Trade Contractors.

G. Cx Report and Documentation

1. The CxA will develop the Systems Manual, including the current facility requirements, and an ongoing Cx plan, with assistance from the GC and Trade Contractors.
2. The CxA will complete the Commissioning Report and all associated documentation for the Owner with assistance from the GC and Trade Contractors.

H. Post-Occupancy Warranty Phase Commissioning

1. The CxA will report any identified operational or performance issues (identified by the building O&M staff or warranty phase Cx activities) to the GC via a Warranty Phase Cx Log for resolution by the GC and Trade Contractors during or prior to the end of the warranty period.
2. The Trade Contractors shall execute any defined seasonal or deferred FPTs, witnessed by the CxA.
3. The CxA may conduct onsite visits to review system operation and performance with the Owner's O&M team and/or may review system trend data during the Warranty Phase and will report any identified issues and recommendations from the trend analysis.
4. No later than either 10 months after substation completion or two months prior to the expiration of the first 12-month warranty period of building occupancy, the CxA will return to the facility to interview facility O&M staff, walk the facility and review systems operation and trend data where applicable. Key representatives from the GC and Trade Contractors shall attend a site walk-through and meeting, as determined by the CxA.

1.8 COMMISSIONING RESPONSIBILITIES

A. General

1. The Commissioning Team and all others involved in the commissioning process shall follow the Commissioning Plan, attend the commissioning kickoff meeting, and attend additional commissioning meetings as necessary.

B. Commissioning Authority (CxA)

1. See Section 019113, General Commissioning Requirements.

C. Owner

1. See Section 019113, General Commissioning Requirements.

D. Design Team

1. See Section 019113, General Commissioning Requirements.

E. General Contractor

1. See Section 019113, General Commissioning Requirements.

F. All Trade Contractors

1. Submit project specific written procedures and blank forms for completing all IV, Startup, and PFCT tasks, including manufacturer's installation checks and startup procedures, as a commissioning submittal. See Paragraph 1.9. Electronic files are acceptable.
2. Provide approved submittals, including shop drawings, control drawings, points list and detailed sequences of operation, meter lists and riser diagrams, etc., for each piece of equipment and system to be commissioned. The system sequence of operation shall fully describe their equipment components and functionality, including setpoints, failure modes and alarm functions. The detailed sequence of operation shall be provided regardless of the completeness and clarity of the sequences in the controls specification and/or drawings. Electronic files are acceptable.
3. Provide a list of any test metering and sensors to be used for sensor and device calibration purposes. All test meter and sensors shall have been calibrated within a year and have calibration documentation.
4. Attend commissioning meetings as directed by the CxA and GC to facilitate the commissioning process.
5. Assign personnel with expertise and authority to act on behalf of the Trade Contractor and schedule them to participate in and perform assigned commissioning tasks.
6. Ensure that any required manufacturer factory tests are performed and provide the factory test data and results where required.
7. Demonstrate and document proper system installation, startup and performance.
    a. Perform IV, Startup and PFCT tasks for all systems and equipment (no sampling), unless the contract or design documents allow for sampling of these tasks.
    b. Ensure that any required manufacturer's representative field tests, inspections, startup and checkout of selected equipment are performed per the contract documents. Provide completed manufacturer documentation and commissioning forms for these activities.
    c. Complete all IV, Startup and PFCT documentation clearly and legibly.
8. Provide a schedule and access for the CxA to witness any equipment Startup and PFCT tasks. Notify the GC and CxA at least 10 days in advance of Startup and PFCT tasks.
9. Address applicable Cx issues promptly. All IV, Startup and PFCT issues must be resolved before the FPTs can proceed.
10. Assist the CxA in preparing the FPT procedures, clarifying the operation and control of commissioned equipment where the specifications, control drawings or equipment documentation are not sufficient for writing detailed testing procedures.
11. Review the FPT procedures to ensure feasibility, safety and equipment protection, and provide necessary written alarm limits, setpoint changes and overrides to be used during the tests.

12. Setup any control system software points, global commands, overrides of any sensor values or relays, and overrides of any setpoints or schedules, to simulate certain conditions and operating modes, in order to conduct the FPTs.
13. Configure all control settings, schedules, alarms, graphics and programming logic for all control systems and any local equipment or stand-alone controls per the project specific sequence of operations.
14. Prior to conducting the CxA witnessed FPTs, place the systems and controls into the operating modes and test and verify all sequences of operation. Check all control system safety cutouts, alarms, and interlocks with other systems during each mode of operation prior to the FPTs. Ensure all systems are operating and performing per the design requirements, and have been pre-tested per the FPTs, and are ready for the CxA witnessed FPTs.
    a. The Trade Contractors shall determine the appropriate level of pre-testing, to prepare for the CxA witnessed FPTs.
15. Perform the FPTs, with the FPTs witnessed by the CxA. Provide at least 10 days advance notice to the GC and CxA for scheduling the FPTs.
16. Setup any Lighting Control System, Power Monitoring or Energy and Water Metering & Sub-metering System, or BAS trends and provide all requested Trend data for the FPTs and post-occupancy warranty phase commissioning review to the CxA.
    a. As an Owner approved option, the Trade Contractors may provide the CxA remote access to the BAS and any other control system, with the Owner's permission, which will allow the CxA to easily and directly download the trend data files.
17. Prepare a training agenda for each training class for the equipment and systems to be commissioned.
18. Coordinate with the GC and Owner to schedule and plan training. Execute training of Owner's personnel per approved training agenda and schedule. Provide copies of training class sign-in sheets and materials / handouts.
19. Prepare O&M Manuals according to the Contract Documents.
20. Assist the CxA in developing the Systems Manual, including providing as-built drawings, controls sequences, setpoints, single-line diagrams, etc., necessary for the Systems Manual.
21. Participate in any applicable integrated whole building tests under emergency power. This test is initiated by disconnecting the utility power to the building, and it will involve multiple disciplines. All Trade Contractors shall participate in the FPTs as required for operation of the inter-related systems.

G. Electrical Trade Contractor

1. In addition to the general Trade Contractor responsibilities outlined above, the Electrical Trade Contractor responsibilities during commissioning shall also include, but are not limited to the following.
2. Prior to any lighting controls startup activity, provide the settings and time schedules to be used for the lighting controls and the process for determining any field adjustable settings, for the CxA and Design Professionals to review (if not fully defined in the sequence of operation). The target / design light levels for determining any applicable

daylight harvest, pre-programmed scenes and/or task tuning control settings shall be obtained from the Design Team.

3. Conduct light level measurements, as applicable (if required per the design and specifications) for determining and/or verifying light levels and performance, settings for task tuning, scene settings or other control functions per the sequence of operation.

4. The FPTs for daylight harvest controls may need to be conducted at both night-time periods (in order to test and verify targeted task light levels are maintained without daylighting) and during day time periods.

1.9 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

A. Trade Contractor Pre-Functional Procedures/Plans and Blank Forms.

1. The Trade Contractors shall submit to the CxA all applicable project specific procedures/plans and blank forms for all required IV, Startup and PFCT tasks for the project, at least 4 weeks in advance of performing any of these tasks. Provided below are the potential procedures/plans and blank forms required for electrical systems, including the content requirements for each. The requirements for the project specific procedures and blank forms will be further described in the Cx Plan.

a. Lighting IV Forms – including the following.

i. IV forms to be used by the Electrical Trade Contractor to verify the installation of the lighting fixtures per the design and manufacturer requirements.

ii. These IV forms can be design, shop or submittal drawing plans that are field verified (for example, with checkmarks next to the individual fixtures) or checklists that are completed on a room by room basis.

b. Lighting Control IV and Pre-Functional Check/Test Forms (Stand-alone Controls & Lighting Control System) – including the following.

i. Checks to verify that all lighting control sensors, wall switches, dimmers, devices and controllers (on a room or area basis) are properly installed per design and manufacturer requirements. These checks shall include both stand-alone lighting controls and the lighting control system (conducted by the Electrical Contractor and/or the lighting control system Manufacturer's Rep.).

ii. Checks to verify all lighting control sensor, wall switch, dimmer and device settings and time delays for occupancy, vacancy, dimming, and daylight harvest control functions, etc., per the design sequence of operation. These checks of the settings and time delays shall include both stand-alone lighting controls and the lighting control system (conducted by the Electrical Contractor and/or the lighting control system Manufacturer's Rep.).

iii. Checks and tests to verify all lighting control sensors, wall switches, dimmers and devices are controlled and operating correctly per the design sequence of operations, including both stand-alone lighting controls and for the lighting control system (conducted by the Electrical Contractor and/or the lighting control system Manufacturer's Rep.).

iv. Checks and tests to confirm the lighting control system sequences of operation for each room and the entire building have been fully programmed and tested,

including any building wide sequences and settings for time schedules, demand respond, etc.

v. Any applicable lighting control system network communication and software checks, trend log configuration checks, alarm configuration checks, and graphical display checks.

c. Electrical System (Service & Distribution and Emergency Power) IV & Pre-Functional Test Procedures and Forms (prior to startup / energization) – including the following.

i. An outline of the applicable NETA visual and mechanical inspections and electrical tests to be conducted for each system / equipment type, following the NETA Standard, where required per design documents.

ii. Indication of who will complete the NETA visual and mechanical inspections and electrical tests (i.e., the Testing Agency or the Electrical Contractor or the Manufacturer's Representative).

iii. An outline of the other applicable IV and pre-functional tests to be conducted for each system / equipment type, where the NETA Standard is not required per contract documents or where other tasks will be performed in addition to those defined in the NETA Standard, including any specific design or manufacturer requirements.

iv. Third-party Testing Agency Qualifications (if a third-party Testing Agency is required per the design documents).

d. Electric Meter IV & Pre-Functional Test Procedures and Forms – including the following.

i. IV forms to verify the meter installation and the meter programming, configuration, setup per the Manufacturer's IOM and design requirements, including the communication modules for BAS integration.

ii. An outline of any electric meter pre-functional tests (e.g., CT ratio tests, meter primary or secondary injection tests, or tests to compare meter readings to a calibrated hand-held device or calibrated known load), required per the design specifications.

e. Electrical System Startup / Energization Procedures & Forms.

i. The startup / energization procedures and forms for the electrical system (service & distribution, emergency Power) can be supplied by the installing contractor, testing agency and/or the manufacturer, and shall include all required startup procedures from the manufacturer's IOM and any tests conducted during or immediately after the startups and energization.

ii. Where required per the design specifications, the startups shall be completed by the authorized manufacturer's representative. In the submittal for the startup procedures and blank forms, the contractor shall indicate which startups will be completed by the authorized manufacturer's representative.

f. Solar Photovoltaic IV & Pre-Functional Test Procedures and Forms – including the following.

i. An outline of the applicable visual inspections and electrical tests to be conducted, where required per design documents or manufacturer requirements.

ii. Include an indication of who will complete the visual inspections and electrical tests (i.e., the Testing Agency or the Electrical Contractor or the Manufacturer's Representative).

iii. Third-party Testing Agency Qualifications (if a third-party Testing Agency is required per the design documents).

g. Procedures/Plans for all other applicable electrical systems IV and PFCT tasks, per the project design and specifications or as requested by the CxA.

2. The CxA will review these submitted commissioning procedures/plans and forms including whether all project specific requirements are included.

3. The CxA may request additional data, changes and/or additions to these forms prior to their use, including forms any supplemental forms provided by CxA, based on the construction documents and specifications, manufacturer installation manuals and procedures, and/or industry standards or guidelines.

B. Training Agenda. The Trade Contractors shall develop a Training Agenda for each training session, per the requirements of the contract documents and specifications, and the LEED Enhanced Commissioning requirements, and may include both operations and maintenance (O&M) staff training and occupant training. The Training Agenda shall be included in the comprehensive Training Plan to be submitted by the GC for review by the CxA, Design Professionals, and/or the Owner (see Section 019113). The GC and Trade Contractors shall coordinate to fully develop the comprehensive Training Plan with input from the Owner.

1. The Training Agenda for each training session shall include the following:

a. equipment and/or systems covered;

b. recommended attendees;

c. proposed location;

d. estimated duration;

e. level of instruction to be provided and an outline of the training topics and subjects to be covered;

f. list of any materials and handouts to be provided (or provided in advance);

g. company to provide the training and the instructor's name and qualifications.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 MEETINGS, SCHEDULING AND COORDINATION

A. See Section 019113.

3.2 DOCUMENTATION

A. The Trade Contractors have specific responsibilities for assisting in the development of equipment check, test and verification procedures and forms, and in performing and documenting commissioning tests, as directed by the GC and as overseen by the CxA.

B. The Trade Contractors shall provide, wherever the Contract Documents require, system checks and testing, test reports, factory test data and reports, checklists, operational verifications and demonstration, etc., whether specified or not in the commissioning sections.

3.3 TEST EQUIPMENT

A. The Trade Contractors shall provide all test equipment in sufficient quantities to execute all Startup, PFCT and FPT tasks in an expedient fashion.

B. The test equipment shall be of industrial quality and suitable for testing and calibration with accuracy within the tolerance necessary to demonstrate system performance per the Contract Documents. If not otherwise specified, the following minimum requirements apply:

C. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 degree F and a resolution to + or – 0.1 degree F.

D. Pressure sensors shall have an accuracy of + or – 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year.

E. The test equipment shall have calibration certification per equipment manufacturer's interval level or within one year if not otherwise specified. The calibration tags shall be affixed or certificates readily available for all test equipment.

3.4 COMMISSIONING PRE-FUNCTIONAL TASKS

A. The Trade Contractors shall conduct all IV, startup procedures and pre-functional checks/tests (PFCTs) without compromise to human or equipment safety. The GC and Trade Contractors shall be responsible for the liability and safety of conducting all startup, checks and tests.

B. The Trade Contractors shall clearly identify and list any issues and deficiencies resulting from the IV, Startup and PFCT tasks on the associated forms and immediately notify the CxA. The CxA will additionally document the issues on the Cx Issues Log. Once issues and deficiencies are corrected and verified, the associated forms shall be updated and resubmitted, and any necessary field review, back-checks or re-tests witnessed by the CxA.

C. The GC and Trade Contractors shall provide a minimum 10 days' notice to the CxA for witnessing equipment Startup and PFCT tasks.

D. The sample rates for the CxA witnessing the Startup and PFCT tasks will be defined in the Cx Plan.

E. The GC and Trade Contractors shall ensure the completion of the IV, Startup and PFCT forms. Review and approval of the completed IV, Startup and PFCT forms by the CxA is required prior to conducting the FPTs. The CxA may create System Readiness Checklists to track the status of the IV, IV, Startup, and PFCT forms, including review by the CxA, prior to the FPTs.

3.5 FUNCTIONAL PERFORMANCE TESTS

A. The Trade Contractors shall perform all FPTs per the final FPT forms, for all systems and equipment in the scope of commissioning. The FPTs shall be witnessed by the CxA unless stated

otherwise by the CxA. The Trade Contractors may need to complete off hours or weekend work in order to complete the FPTs. The CxA will document all testing results on the FPT forms.

B. As outlined in the Part 1, a sampling approach shall be used for the FPTs of identical systems and equipment, using the in the Cx Plan, with the specific systems and equipment selected by the CxA.

C. The Trade Contractors shall determine what level of pre-testing is appropriate in order to prepare for the CxA witnessed FPTs.

D. The GC and Trade Contractors shall coordinate all FPTs with the CxA, and provide a minimum of 10 days' notice prior to conducting each test.

E. The GC and Trade Contractors shall have responsibility for the liability and safety of conducting all functional performance tests.

F. The Trade Contractor executing the test shall provide all necessary materials, system modifications, etc. to produce the conditions and operating modes, etc. to execute the test according to the test procedures.

1. The Trade Contractors shall provide any necessary control system global or system level commands and setpoint adjustments necessary to conduct the testing as called out in the FPT procedures.

G. At completion of the test, the Trade Contractor shall return all affected building equipment and systems to their pre-test normal condition.

3.6 TREND ANALYSIS

A. The CxA may conduct trend analysis as part of the FPT process, after completion of the onsite field conducted FPTs and correction of all issues and deficiencies, to verify integrated system operation and performance.

B. If required, the CxA will prepare a lighting control system trend points list including the trend interval. The BAS Trade Contractor shall set up the trend log definitions prior to the start of the sequence of operation FPTs.

C. The Trade Contractors or Lighting Control System Manufacturer's Representative shall provide the trend to the CxA in an electronic format, either a text file, CSV file or Excel file, with related system parameters grouped together. The estimated duration for the trend data is 1 to 3 weeks (with a minimum of 1 weeks' worth of data).

D. If the CxA discovers any control or performance issues during trend analysis, the Trade Contractors or Lighting Control System Manufacturer's Representative shall correct the issues and provide new trend data for analysis verification by the CxA.

3.7 COMMISSIONING ISSUES, BACK-CHECKS AND RE-TESTS

A. When Cx issues are identified during testing, the CxA will discuss with the executing Trade Contractor and/or GC and determine whether or not testing can proceed. The CxA may allow immediate correction of minor issues and deficiencies identified during testing. The Cx issue and

any identified resolution will be documented on the test form in use in addition to the Cx Issues Log.

B. The CxA will maintain and update the Cx Issues Log, and document the issue resolution process. Copies will be distributed to the GC, Owner, and Trade Contractors as appropriate. The Trade Contractors shall provide updates and comments regarding issue status and resolution.

C. The Trade Contractors shall promptly correct all Cx issues. The responsible party shall correct the issue and inform the GC and CxA of the resolution and completion date, and update the Cx Issues Log accordingly (in the fields assigned for contractor updates).

D. The CxA will record completion on the Cx Issues Log after a successful witnessed re-test, field review, back-check, verification obtained through appropriate documentation or photographs, or acceptance by the Design Team or Owner. The GC shall reschedule any applicable re-testing with the CxA and Trade Contractor. The Trade Contractor shall retest until achievement of passing performance or Owner acceptance of the noted issue.

E. Where sampling is used for the PFCTs and FPTs, the results shall be deemed acceptable once all noted issues are resolved and any new sample tests or checks have passed.

F. Additional parties may require input during a dispute regarding a Cx issue. Regardless of the validity or responsibility of the issue, the CxA will have the final interpretive authority on Cx issues and the Owner will have the final approval authority.

G. The CxA may recommend solutions to Cx issues. However, the GC and Trade Contractors ultimately have the burden of responsibility to solve, correct and perform required retests.

H. Back-checks, Verifications and Re-testing:

1. The CxA will witness one (1) re-test or will perform one (1) field back-check or verification of any Cx issue.
2. The CxA's total onsite time for re-test witnessing and field verification or back-check of Cx issues will be limited to no more than 1 work days (full 8-hour work days) for all applicable mechanical, electrical, and plumbing systems in the commissioning scope.
3. The Owner may back-charge the GC for any additional fees from the CxA, resulting from any additional re-testing or field back-checks or verification beyond this allocated total time.
4. The GC must provide a minimum 48 hours' notice for scheduling any re-testing, though the CxA will attempt to accommodate a shorter timeframe if feasible.
5. Any required re-testing shall not be considered a justified reason for a claim of delay or for a time extension.
6. For any re-testing required, the CxA will determine if the entire test must be re-tested or if it is acceptable to re-test specific portions of the test that had failed.

3.8 DEFERRED & SEASONAL TESTING

A. Before or during the end of the first year warranty period, the Trade Contractor shall complete any seasonal or deferred testing, required per the design specifications and as defined in the Cx

Plan. The Trade Contractors shall complete tests in the same manner as all other commissioning tests, including CxA witnessing.

1. If applicable, for this project, deferred electrical testing (infrared scanning) per the project specifications.

B. The GC and Trade Contractor shall coordinate with CxA and Owner and schedule all deferred and seasonal testing.

3.9 TRAINING VERIFICATION

A. The GC and Trade Contractors shall coordinate and schedule the training for the Owner's facility and operations personnel, and building occupants. The GC shall ensure that training is completed per the requirements of the contract documents and specifications.

B. Trade Contractors responsible for specific equipment and system training shall submit to the GC, a written training agenda for each training class for the equipment and systems to be commissioned. The GC shall submit a comprehensive Training Plan, including the specific training agendas, to Owner, Design Team and CxA for review and approval. See also Section 019113.

C. The CxA will review the Training Plans for commissioning verification prior to conducting the actual training.

D. For verification of actual training conducted, the GC shall submit to CxA 'attendee signed' attendance sheets for each training session conducted and a copy of any final training presentations or handout materials.

3.10 COMMISSIONING ACCEPTANCE, CLOSE-OUT AND REPORTING

A. Completion of the main commissioning activities (system readiness checks, functional performance testing, and training) shall be accomplished as a prerequisite for substantial completion. Completion of any re-testing shall be completed prior to final acceptance of commissioning.

B. After completion of the main commissioning activities and following review of the completed commissioning documents, test results and the current Cx Issues Log with the Owner, the Owner will indicate whether they accept completion of the project construction phase commissioning or if not, the requirements for acceptance. Upon Owner acceptance, any remaining open Cx issues will be transferred to the warranty phase Cx Issues Log for tracking resolution and completion as part of the warranty phase commissioning.

C. Upon completion of all commissioning activities, the CxA will prepare and submit to the Owner a Cx Report detailing all completed commissioning activities and documentation. The GC shall support this effort by providing all Trade Contractor commissioning documentation.

D. The CxA will complete a Systems Manual for the systems and equipment commissioned, following the LEED requirements, with assistance provided by the GC and Trade Contractors. The Systems Manual will provide the operating staff the information needed to understand and optimally operate the commissioned systems. It will also include the current facility requirements, and an ongoing commissioning plan.

3.11 POST-OCCUPANCY WARRANTY PHASE COMMISSIONING

A. The Trade Contractors shall execute any defined seasonal or deferred FPTs, witnessed by the CxA, to be witnessed by the CxA, unless stated otherwise by the CxA.

B. The CxA may conduct onsite reviews of the system operation and performance, meet with the O&M Team to discuss system operation and performance, and may also review BAS or lighting control system trend data during the Warranty Phase. The BAS or Electrical Trade Contractor shall be responsible for providing post-occupancy trend data to the CxA.

C. The CxA will report any identified issues and recommendations to the GC via a Warranty Phase Cx Issues Log for review and resolution by the GC and Trade Contractors prior to the end of the warranty period, for any issues or recommendations identified either by the CxA or the Owner. The GC shall work with the Trade Contractors and O&M staff to make corrections and adjustments as required to address the issues and recommendations.

D. Key representatives from the GC and Trade Contractors shall attend a near end of warranty commissioning review meeting, to be scheduled with the Owner's facility staff and the CxA, no later than either 10 months after substation completion or two months prior to the expiration of the first 12-month warranty period of building occupancy.

1. During this meeting, the operation and performance of the systems will be discussed with the Owner's staff, the results of any commissioning reviews and trend analysis will be discussed and the Warranty Phase Cx Issues Log will be reviewed. If needed, a walk-through of the systems with the Owner's staff will be conducted.

2. Next steps and actions items for any open Cx issues and recommendations will be discussed and documented via meeting minutes or a field report issued by the CxA. The intent is to resolve any open Cx issues prior to the end of the warranty phase.

E. After correcting noted Warranty Phase Cx issues, the GC shall notify the CxA, and the CxA will back-check and verify resolution of the issues and recommendations.

F. Issues identified during the warranty period will remain warranty phase Cx issues until satisfactory completion by Trade Contractors, even if the warranty period expires during the correction and back-check period.

END OF SECTION 260810

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 2716 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hinged cover enclosures.
   2. Cabinets.
   3. Terminal blocks.
   4. Accessories.

B. Related Requirements:
   1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   3. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.

C. Manufacturer's 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.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. General Conditions: Requirements for maintenance materials.

B. Extra Stock Materials:
   1. Furnish two of each key.

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 HINGED COVER ENCLOSURES

A. Description: NEMA 250, Type 1 or 3R steel enclosure.

1. Covers: Continuous hinge, held closed by hasp and staple for padlock.
2. Furnish interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.
3. Enclosure Finish: Manufacturer's standard enamel.

2.2 CABINETS

A. Description:
   1. Boxes: Galvanized steel with removable end walls.
   2. Backboard: Furnish 3/4 inch (19 mm) thick plywood backboard for mounting terminal blocks. Paint matte white.
   3. Fronts: Steel.

B. Fabrication
   1. Furnish metal barriers to form separate compartments wiring of different systems and voltages.
   2. Furnish accessory feet for free-standing equipment.

C. Finishes:
   1. Finish with gray baked enamel.

2.3 TERMINAL BLOCKS

A. Description:
   1. Terminal Blocks: NEMA ICS 4.
   2. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
   3. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
   4. Furnish ground bus terminal block, with each connector bonded to enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 26 05 29.

B. Install cabinet fronts plumb.

3.2 CLEANING

A. General Conditions: Final cleaning.

B. Clean existing cabinets and enclosures to remain or to be reinstalled.

C. Clean electrical parts to remove conductive and harmful materials.

D. Remove dirt and debris from enclosure.

E. Clean finishes and touch up damage.

END OF SECTION 26 27 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, 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.

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.

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 a complete and operational communications system 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. 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 41 00: Audio Visual Systems
9. 27 41 16: AV and Safety Alert Systems
10. 27 51 13: Paging Systems
11. 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. 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-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/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).

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. 2002 NFPA National Electrical Code, Section 800-52, Paragraph 2(b), 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 Constructions 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. Smoke and Acoustical Cable Pathways
4. Fire Stop Pathways
5. Penetrations
6. Wire Cable Tray
7. Pull Boxes
8. Velcro Tie Wraps
9. Cable Hangers (J-Hooks)
10. Measuring Tape and Pull String
11. Innerduct
12. 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 41 00: Audio Visual Systems
6. 27 41 16: AV and Safety Alert Systems
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 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. Smoke and Acoustical Cable 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. 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 CABLE TRAY WALL PENETRATIONS AT NON-RATED WALLS

A. Where wire cable trays penetrate non-rated walls, stop cable tray short of wall and provide smoke/acoustical pathways.

B. Pathways shall contain a built-in sealing mechanism and shall automatically adjust to the installed cables.

C. Pathways shall allow cables to be installed, removed or retrofitted without the need to remove or reinstall acoustical materials.

D. Pathways shall provide a minimum Sound Transmission Classification (STC) of 61.

E. Do not exceed 40% cable fill ratio through pathways.

F. Acceptable Products:

1. STI Technologies EZ Path 33NEZ.
2. Or Approved Equal.

2.5 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.

2.6 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.

2.7 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.

2.8 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.

2.9 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.

2.10 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.

2.11 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 hangars 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. Contactor 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 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 15” Wide X 20” Long.
3. Precast Hand Holes and Covers 18” Wide X 30” Long.
4. Precast Pullboxes and Covers 30” Wide X 48” Long.
5. Multi-cell fabric innerduct.
6. Muletape (Pull rope).
7. 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 05 43: Exterior Communications Pathways
3. 27 11 00: Communications Equipment Room Fittings
4. 27 13 00: Communications Backbone Cabling
5. 27 15 00: Communications Horizontal 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 15" Wide X 20" Long.
3. Precast Hand Holes and Covers 18" Wide X 30" Long.
4. Precast Pullboxes and Covers 30" Wide X 48" Long.
5. Multi-cell fabric innerduct.
6. 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. The PVC conduit shall transition to rigid metal conduit a minimum of 10 feet from the building foundation. Rigid metal conduit shall be routed from that point to the stub up location in the building.

B. Conduit stub-ups in the telecom rooms shall be vinyl coated rigid steel.

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.

2.5 TELECOM PULL BOXES (15” WIDE X 20” LONG)

A. Provide precast telecom pull boxes where shown on the drawings.

B. Pull boxes shall have the following inside dimensions 15” wide x 20” long.

C. Provide lockable concrete lid.

D. Provide additional reinforced concrete risers as required to maintain conduit depth as shown on the drawings.

E. Acceptable Products:

a. Jensen Precast HN1017 pullbox and HN1017-L01 Lid.
b. Or Approved Equal.

2.6 TELECOM PULL BOXES (18” WIDE X 30” LONG)

A. Provide precast telecom pull boxes where shown on the drawings.

B. Pull boxes shall have the following inside dimensions 18” wide x 30” long .

C. Provide lockable concrete lid with 12” riser.

D. Provide additional reinforced concrete risers as required to maintain conduit depth as shown on the drawings.

E. Acceptable Products:

a. Jensen Precast HN1730 pullbox, HN1730-E extension and HN1730-L01 Lid.
b. Or Approved Equal.

2.7 TELECOM PULL BOXES (30” WIDE X 48” LONG)

A. Provide precast intercept telecom pull boxes where shown on the drawings.

B. Pull boxes shall have the following inside dimensions 2’-6” wide x 4’-0” long by 2’-6” high.

C. Pull boxes shall have a 12” reinforced concrete riser. Provide quantity of risers to maintain conduit depth as shown on the drawings.

D. 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.

E. Provide incidental H-20 rated covers with diamond plate surface. Covers shall be labeled “COMMUNICATIONS”.

F. Acceptable Products:

a. Jensen Precast 3048 intercept pullbox (PB3048-I) with 12” Riser (RS304812) and H-20 Cover (CA3048C61).
b. 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 41 00: Audio Visual Systems

6. 27 41 16: AV and Safety Alert Systems
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 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, 2017 -- 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 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-014.

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-014.

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-014.

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-014.

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-014. 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-014.

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-014.

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-014 dated October 21, 2016.

C. Work Area Outlet Face Plates: See WCSD-SCS-014 for requirements.

D. Work Area Data and Voice Jacks: See WCSD-SCS-014 for requirements.

E. Work Area Horizontal Data, Voice and Video Cable: See WCSD-SCS-014 for requirements.

F. Telecom Room Horizontal Data, Voice and Video Cable: See WCSD-SCS-014 for requirements.

G. Patch Panels: See WCSD-SCS-014 for requirements.

H. Patch Panel Ports: See WCSD-SCS-014 for requirements.

I. Fiber Termination Cabinets: See WCSD-SCS-014 for requirements.

J. 110 Blocks: See WCSD-SCS-014 for requirements.

K. Backbone Cables: See WCSD-SCS-014 for requirements.

L. Equipment Racks and Cabinets: See WCSD-SCS-014 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. 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

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 41 00: Audio Visual Systems
8. 27 41 16: AV and Safety Alert Systems
9. 27 51 13: Paging Systems
10. 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, 2017 -- 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. 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" cat 5E patch cords jacket color blue.

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.

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”.
6. Access Control System: Icon insert color “Blue”.

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.

C. Provide one (1) 4'-0" CAT 6 patch cord for each data drop related to the following systems:

1. CCTV System: Patch Cord Color "Black".
2. Audio Enhancement System: Patch Cord Color "Gray".
3. Paging System: Patch Cord Color "Green".
4. Access Control System: Patch Cord Color "Blue".

D. 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

E. Patch cords shall be rated for use as communications cable and shall have the designation "CM" or "CMR" printed on the jacket.

F. 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 CATEGORY 6 ENTRANCE TERMINALS WITH PRIMARY PROTECTOR MODULES

A. Provide CAT 6 building entrance protectors where OSP CAT 6 cable from pole mounted camera(s) enters the building.

B. Surge protectors shall be bonded to ground with #6 green insulated ground conductors.

C. Surge Protectors shall have the following physical characteristics:

1. UL 497, UL 497A and UL 497B listed for primary, secondary and isolated loop circuit protection.
2. Ultra low capacitance solid state technology providing protection transparent to frequencies up to 250 MHz.
3. Factory loaded with 65V solid state modules.
4. 110 style terminations.

D. Acceptable Products:

1. Tii Networks (Formally Porta Systems) P/N 606-65 with LVP65 protection modules.
2. Or Approved Equal.

2.13 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.
   a. 4RU Cabinet - Belden/CDT P/N AX105565.
   b. 24-Fiber Multimode duplex LC fusion splice cassette – Belden/CDT P/N FCH12LDFS. Provide 12-fiber OM4 multimode fusion splice pigtails to terminate all multimode fiber (Belden P/N FT4LD900PR123ME).

c. 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).
d. Provide blank covers for all unused fiber termination panel cassette openings (Belden P/N FFZH00BB).
e. No Substitutions.

2. Fiber Termination Cabinets & Fusion Splice Cassettes Located in the IDF's:
a. 2RU Cabinet - Belden/CDT P/N AX105564.
b. 24-Fiber Multimode duplex LC fusion splice cassette – Belden/CDT P/N FCH12LDFS. Provide 12-fiber OM4 multimode fusion splice pigtails to terminate all multimode fiber (Belden P/N FT4LD900PR123ME).
c. 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).
d. Provide blank covers for all unused fiber termination panel cassette openings (Belden P/N FFZH00BB).
e. No Substitutions.

2.14 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 48-port copper patch panel (including spare patch panels), contractor shall provide qty (2) 5-meter duplex LC OM4 multimode fiber patch cords (Belden/CDT P/N FP4LDLD005MR2XA) and qty (2) 3-meter duplex LC OM4 multimode fiber patch cords (Belden/CDT P/N FP4LDLD003MR2XA).

E. For every installed 12-strand and 6-strand Singlemode fiber optic cable, provide qty (2) 3-meter duplex LC OS2 singlemode fiber patch cord (Belden/CDT P/N FPSLDLD003MR1XY).

F. Acceptable Products:
1. 3-Meter duplex LC OM4 Multimode Patch Cords – Belden/CDT P/N FP4LDLD003MR2XA.
2. 5-Meter duplex LC OM4 Multimode Patch Cords - Belden/CDT P/N FP4LDLD005MR2XA.
3. 3-Meter duplex LC OS2 singlemode patch cords – Belden/CDT P/N FPSLDLD003MR1XY.
4. No Substitutions.

2.15 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/EIA-607-A.

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 Elevation Kit (Black). CPI Part Number 10506-706. 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.

2.16 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 (50) 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.

2.17 GROUNDING BARS

A. The entire telecom grounding system including grounding bars, grounding conductors, lugs, etc shall be installed in accordance with ANSI-J-STD-607-B "Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications".

B. Provide UL listed copper grounding bars with insulated standoffs and stainless steel mounting brackets. Provide the size and quantity of grounding bars as shown on the drawings.

C. Telecommunications grounding bus bars (TGB) located in the telecom rooms (IDF's) shall be copper 12" x 2" x ¼" UON on the Drawings.

D. The telecommunications main grounding bus bar (TMGB) located in the Equipment Room (MDF) shall be copper 20" x 4" x ¼" UON on the Drawings.

E. Grounding bars shall have BICSI patterned pre-drilled lug mounting holes to accommodate two hole lug attachment. 5/16" hole sets shall be spaced on 5/8" centers. 7/16" hole sets shall be spaced on 1" centers.

1. Acceptable Products
   a. Chatsworth 13622-012 (2" high), 40153-020 (4" high).
   b. Erico TGB-A20L12PT (2" high), TMGB-A20L27PT (4" high).
   c. Harger GBI14220TGB (2" high), GBI14420TMGB (4" high).
   d. Or approved equal.

F. Provide separate green insulated #6 AWG grounding conductors from equipment racks, cabinets, metallic backboards, cable sheaths, metallic strength members, ladder rack, conduits, splice cases and building entrance terminals to the grounding bar in each telecom room. Do not "daisy chain" ground conductors.

G. Grounding bars (TGB's) located in the telecom rooms shall be bonded to the grounding bar (TMGB) located in the Equipment Room with a telecom bonding backbone (TBB) conductor. The TBB shall be continuous without splices. The minimum TBB conductor size shall be 3/0.

H. Provide an insulated grounding conductor (#2 AWG minimum) from the ground bar in each telecom room to building steel. The grounding conductor shall be cad welded to the building steel. See grounding riser detail for conductor sizes and additional grounding requirements.

I. Provide an insulated grounding conductor (#2 AWG minimum) from the ground bar in each telecom room to an approved electrical ground (electrical panel ground serving the telecom room). See grounding riser detail for conductor sizes and additional grounding requirements.

J. Ground wires shall have solderless, copper, two bolt, two hole long barrel compression lugs placed on both ends. The two bolt lug holes shall be ¼" and on ¾" centers.

K. All grounding conductors shall be green in color. All cables and bus bars shall be identified and labeled in accordance with the recommendations made in ANSI/TIA/EIA-606-A.

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.

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.

3.10 GROUNDING AND BONDING

A. All components of the Telecommunications system shall be bonded and grounded in accordance with ANSI/TIA-607-B “Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications”.

B. Bond equipment racks, cabinets, wiring blocks, conduits, cable tray, ladder rack, building entrance terminals and cable shields to the ground bar in each telecom room with #6 AWG ground conductors. Provide a separate ground conductor for each item. Do not daisy chain ground conductors.

C. Bond the ground bar in each Telecom room to building steel (#2 AWG minimum). Cad weld the grounding conductor to the building steel. See grounding riser diagram for ground conductor sizes.

D. Bond the ground bar in each Telecom room to the electrical panel serving that Telecom room (#2 AWG minimum). See grounding riser diagram for ground conductor sizes.

E. Bond the Telecommunications Ground Bar (TGB) in each Telecom room to the Telecommunications Main Ground Bus (TMGB) with a Telecommunications Bonding Backbone (TBB) conductor. The minimum TBB conductor size shall be minimum 3/0. See grounding riser diagram for ground conductor sizes.

F. Bond the Telecommunications Main Ground Bus (TMGB) to the main electrical building ground (#2 AWG minimum). See grounding riser diagram for ground conductor sizes.

G. Grounding conductors shall be installed continuous. There shall be no splices or mechanical couplers.

H. Locate the Telecommunications Main Grounding Bar within 5’-0” of the building entrance terminal(s) (BET).

I. The Electrical Contractor shall test the continuity of all grounding conductors.

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. Multimode OM4 Tight Buffered Fiber Optic Cabling – Indoor/Outdoor
3. 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, 2017 -- 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. Multimode OM4 Tight Buffered Fiber Optic Cabling – Indoor/Outdoor
3. 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 Corning LANScape.

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 (12-Strand SM) and P/N FDSD006R9 (6-Strand SM).
   2. No Substitutions.

2.2 MULTIMODE OM4 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 cables shall be tight buffered with a 50/125µm-core/cladding diameter.

D. Fiber optic cable shall be OM4 laser optimized and rated for 10 Gigabit Ethernet at a distance of 300 meters.

E. Fiber Optic cabling shall have a riser rated jacket (OFNR).

F. Fiber optic cables shall be tight buffered with a black colored jacket.

A. Fiber optic cable shall comply with the requirements of ANSI/TIA/EIA-568-B.3 Addendum 1 “Additional Transmission Performance Specifications for 50/125 µm Optical Fiber Cables”.

B. Maximum attenuation and bandwidth characteristics
   1. Maximum attenuation 3.5/1.25 dB/Km @ 850/1300 nm.
   2. Bandwidth 3000 MHz-km @850 nm.
   3. Bandwidth 500 MHz-km @1300 nm.

C. Physical Characteristics
   1. Cable will have 900 µm buffer with mechanically strippable PVC jacket.
   2. The designation “UL” and either “OFNP” or “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 orange jacket.
   4. The cable shall contain an aramid yarn strength member with cables stranded around center.

5. The cable shall be suitable for temperatures of -40º to +70º C.

H. Acceptable Products:

1. Belden/CDT P/N FD4D024R9 (24-Strand MM).
2. No Substitutions.

2.3 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 fiber optic cable shall be installed within fabric innerduct. Where the innerduct terminates at the telecom room wall or floor, install riser rated corrugated innerduct from that point to the fiber termination cabinet.

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. 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 05 43: Exterior Communications Pathways
4. 27 08 00: Commissioning of Communications
5. 27 11 00: Communications Equipment Room Fittings
6. 27 41 00: Audio Visual Systems
7. 27 41 16: AV and Safety Alert Systems
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 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-568.2-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.

C. Physical Characteristics

1. Category 6 cable shall meet or exceed the requirements of ANSI/TIA/EIA–568-B.2 and ANSI/TIA/EIA–568-B.2 Addendum 1.

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.

D. Transmission Characteristics

1. Cable shall conform to ANSI/TIA/EIA–568-B.2 Addendum 1 as shown below.

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.

E. 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/EIA–568-B.2-10 -- for Augmented Category 6 Cable.

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/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

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.

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 6/6A cable routed in underground and/or under slab conduit shall be indoor/outdoor rated suitable for wet locations.

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 (no splices) except for transition points or consolidation points specifically shown on the drawings.

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.

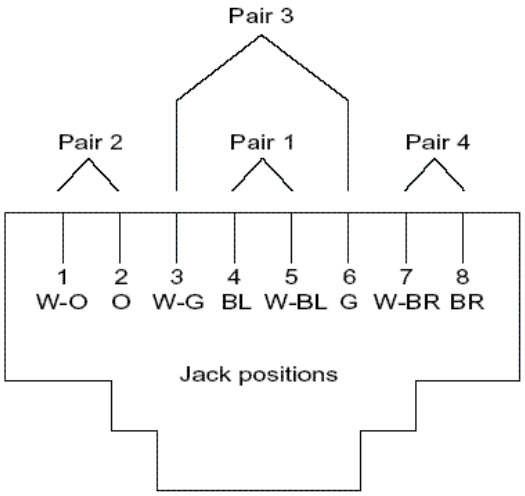
K. Cables shall be installed in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer’s recommendations and installation guides, and best industry practices.

L. 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 274100 – AUDIO VISUAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

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 Audio Visual (A/V) Systems as shown on the Drawings and described in the Specifications.

B. Provide Audio / Visual system for the Elementary School Multipurpose Room stage consisting of the following components:

1. Qty (1) Wall mounted 10RU AV equipment cabinet with lockable vented door. Provide power and network connections at AV cabinet as shown on the drawings.
2. Qty (2) wall mounted self-powered loudspeakers. 120V electrical outlet to be provided at each speaker location.
3. Qty (2) loudspeaker wall support systems including yokes, fasteners, safety support wires, etc.
4. Shielded 2-conductor 22 gauge cabling from loudspeakers to AV cabinet.
5. Qty (1) wall mounted combination XLR microphone and audio input plate.
6. Shielded 2-conductor 22 gauge XLR microphone and audio input plate cabling from XLR microphone and audio plates to the AV cabinet.
7. Qty (1) 7,000 lumen wall mounted projector with HDBaseT input. 120V electrical outlet to be provided at projector location.
8. Qty (1) Projector mounting cage for mounting and protection of projector including projector cage, strut, fasteners, etc.
9. CAT 6A plenum HDBaseT cable from projector to AV cabinet.
10. Qty (1) Wall mounted HDBaseT AV input plate with HDMI, USB-C and USB inputs.
11. CAT 6A plenum HDBaseT cable from AV input plate to AV cabinet.
12. Qty (1) HDBaseT audio/video matrix switcher rack mounted in AV equipment cabinet.
13. Qty (1) Digital Signal Processor (DSP).
14. Qty (1) 5” POE touch screen controller.
15. Qty (1) wireless microphone receiver with rack mount kit.
16. Qty (1) handheld wireless microphone.
17. Qty (1) wired microphone with stand.
18. Qty (1) FM assisted listening system kit consisting of qty (1) wireless transmitter, qty (10) receivers, qty (3) neck loops, qty (7) ear buds, qty (1) 12-bay receiver charging station, rechargeable receiver batteries.

C. The Specifications list equipment, devices, software and programming that comprise the overall Audio Visual System. The Contractor shall integrate all individual items so that they function together as one overall system. The Contractor shall provide all necessary equipment, cabling, software, programming and ancillary items as required to integrate all components.

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

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. ANSI/InfoComm.
2. NFPA-70, 2017 -- National Electrical Code (NEC).
3. FCC Regulations:
   a. Part 15 – Radio Frequency Devices & Radiation Limits
4. Underwriter’s Laboratories, Inc. (UL).
5. Electronic Industry Association (EIA) testing standards
6. Americans with Disabilities Act (ADA)
7. American Standard Code for Information Interchange (ACSI)
8. American Society for Testing and Materials (ASTM)
9. National Electrical Manufacturers' Association (NEMA)

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:

1. The contractor shall be licensed by the Nevada State Contractors Board.
2. The Contractor shall have a minimum of five (5) years experience in the installation, integration and testing of Audio Visual Systems of similar size and scope.
3. The Contractor shall be a firm normally engaged in the design, installation and maintenance of Audio Visual Systems. The Contractor shall provide details of at least three (3) projects of similar size and scope involving the design, installation and testing of Audio Visual Systems in the last 5 years. Names, addresses and telephone numbers of references for the three projects shall be included.
4. The Contractor shall have service facilities near the project site and shall respond to service phone calls within one (1) business day of receipt. The Contractor shall provide an on-site response time of two (2) business days for critical system items during regular business hours.

B. UL Listing and Labeling: Unless specific equipment specified within the Audio Visual Specifications is not listed or labeled by UL, provide components listed and labeled by UL.

C. All work shall conform to the National Electrical Code (NEC) and to applicable National Fire Protection Association (NFPA) codes.

D. Compliance with Local Requirements: Comply with the applicable building code, state and local ordinances, and regulations and the requirements of the authority having jurisdiction.

E. All equipment supplied shall be listed by a nationally recognized test laboratory where applicable.

F. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

G. All items of a given type shall be the products of the same manufacturer.

H. All items shall be of the latest technology; no discontinued models or products are acceptable.

I. The manufacturer, or their Authorized Representative, shall confirm that within 300 miles of the project site there is an established agency which:

1. Stocks a full complement of parts.
2. Offers service during normal working hours as well as emergency service on all equipment to be furnished.
3. Will supply parts and service without delay and at reasonable cost.
4. Contractor shall be capable of performing service or maintenance work on these specified or accepted systems. Contractor shall be factory-certified where such certification is available or required.

1.5 INTENT OF DRAWINGS

A. Layout: Follow the general layout shown on the Drawings except where other work may conflict with the Drawings.

B. Accuracy: The Drawings show a diagrammatic representation of the system. Field verify all dimensions and locations.

C. Provide detailed point-to-point wiring and block diagrams of the entire Audio Visual System. Submit cut sheets of all equipment, equipment enclosures, devices, cabling, software, etc. for review approval prior to installing the work.

1.6 REVIEW OF SPECIFICATIONS

A. 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. 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.

1.7 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 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.

1.8 AUDIO VISUAL SYSTEM INTEGRATION

A. The Contractor will be responsible for integrating each individual system component so that the systems function as one overall Audio Visual System.

B. The Contractor shall provide all necessary programming, software, software licensing, software development kits (SDK's), cabling, AV equipment and ancillary items required to achieve this integration.

C. Where more than one acceptable manufacturer is listed for a specific A/V component, the Contractor will be responsible for verifying that the manufacturer's equipment can be integrated into the overall Audio Visual System.

1.9 SUBMITTALS

A. Submit manufacturer product data sheets for all system components and cabling.

B. Product Data Sheet Submittals shall comply with the following:

1. Product data submittals must be submitted to and approved by the Owner prior to release of order for equipment and prior to installation.
2. Submit product data sheets in PDF format.
3. Provide the following information in the submittal:
    a. Client Name.
    b. Project Number and Contract Number.
    c. Project Name and Address.
    d. Contractor's Submittal Number.
    e. Submittal Title.
    f. Specification Section Number.
    g. Date of Submittal.
    h. Contractor Name and contact information.
4. Provide a table of contents indicating the products submitted.
5. Products listed in the table of contents should be in the same order as they appear in the Specifications.
6. Submittals must include all items identified in each specification section. Partial submittals will not be accepted.
7. Where product data sheets cover more than one distinct item, clearly indicate by arrows or brackets precisely what is being submitted including optional accessories. Delete or cross-out non-applicable data.

C. Shop drawings:

1. All Audio / Visual System drawings generated for this project shall be created utilizing AutoCAD 2007 or newer file format.
2. Drawings shall be drafted on 30" x 42" sheets to match the contract drawings.
3. Submit shop drawings for all equipment showing:

a. Location and layout of all field devices, equipment, termination blocks and panels on the floor plans.
b. Single line diagrams for devices, equipment and components. Single line diagrams shall identify all devices and equipment and shall include all interconnecting wiring, cable types and sizing. Provide manufacturers wire type where required.
c. Block diagram(s) depicting system integration details.
d. Elevations of Audio Visual cabinet showing equipment mounting locations, electrical outlet locations, termination equipment.
e. Drawings for each field device type detailing wiring and mounting instructions.
f. Point-to-point wiring data, utilizing a combination of AutoCAD generated drawings and device/equipment Excel schedules.
g. Provide all Graphical User Interface screen layouts, menu and navigation structures (where applicable). Layouts shall be created by the GUI configuration software and shall not consist of line drawings created by CAD programs.

D. Operation and Maintenance Manuals

1. Quantity: Furnish three (3) O&M Manuals.
2. Format:
   a. Furnish each O & M Manual in a white, 3-ring binder with front cover and spine clear pockets for insertion of the project information.
   b. Clearly label the cover of each O & M Manual with the following information:
      (1) Client Name.
      (2) Project and Contract Numbers.
      (3) Project Name and Address.
      (4) Manual Name .
      (5) Date of Submittal
      (6) Contractor Name.
   c. Include a Table Of Contents at the beginning that lists the contents.
   d. Include tabbed separators for improved navigation through the manual.
3. Content:
   a. Functional Design Manual: Includes a detailed explanation of the operation of the system.
4. Hardware Manual which includes:
   a. Pictorial parts list and part numbers.
   b. Pictorial and schematic electrical drawings of wiring systems, including devices and equipment.
   c. Telephone numbers for the authorized parts and service distributors.
   d. Include all service bulletins.
5. Operator’s Manual which full explains all procedures and instructions for the operation of the system and includes:
   a. System start up and shut down procedures.
   b. Use of system.
   c. Equipment recovery and restart procedures.
   d. Software and firmware backup procedures (where applicable).
6. Maintenance Manual which includes:
   a. A summary of the TCP/IP address used and which system component they are associated with. Include the gateway address, subnet mask, DNS server, and host name information.
   b. Manufacturer’s warranty certificates.

E. Software

1. Provide copies of system software upon final system turnover. Software discs and documentation shall be bound in a three ring, hard cover binder that shall include at a minimum, the following items:
   a. Software drivers.
   b. Device / Equipment firmware.
   c. GUI runtime software licenses (where applicable).
   d. Original and final passwords (at time of final completion) to access all devices and equipment.
   e. IP addresses of all network equipment.

F. Record Drawings

1. See Division 1 Specifications for additional record drawing requirements.
2. Content:
   a. Fully represent actual installed conditions and incorporate all revisions made during the course of construction.
   b. Include drawings submitted as part of the Shop Drawing package, plus any additional information required to accurately document installed conditions.
   c. Device addresses & IP address information.
   d. Floor plans shall show:
      (1) Locations and identifiers of all devices.
      (2) Size, quantity, location, and routes of all pathways (such as cable trays, conduits, J-hangers, and other cable support devices).
      (3) Equipment rack elevations scaled at 1”=1’-0” showing exact placement of all system equipment.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery.

1. Do not deliver products to the site until protected storage space is available. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at jobsite.
1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels (name of the manufacturer, product name, type, grade, UL classification, etc.) intact.
2. Replace materials damaged during shipping at no cost to the Owner.

B. Storage.

1. Store materials in clean, dry, ventilated space free from temperature and humidity conditions (as recommended by manufacturer) and protected from exposure to harmful weather conditions.
2. Comply with manufacturer's requirements for each product. Comply with recommended procedures, precautions or remedies as described in the Material Safety Data Sheets (MSDS) as applicable.
3. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic.
4. Storage outdoors covered by rainproof material is not acceptable.
5. Provide heat where required to prevent condensation or temperature related damage.

C. Handling.

1. Handle in accordance with manufacturer's written instructions.
2. Damaged equipment shall not be installed.
3. Replace damaged equipment at no cost to the Owner.
4. Handle with care to prevent internal component damage, breakage, denting, and scoring.

1.11 SUBSTITUTIONS

A. No material substitutions will be allowed except by written acceptance from the Owner's Representative. 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.

B. Approval of alternate or substitute equipment or material in no way voids the Specification requirements.

C. Under no circumstances shall the Owner's Representative 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.

1.12 WARRANTY

A. The warranty period will begin after substantial completion of the project.

B. The complete Audio / Visual System including all devices, equipment, 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.

C. Provide maintenance of systems and equipment for a period of one (1) year from date of substantial completion.

D. All Audio / Visual equipment shall have a three (3) year warranty. Defective or damaged equipment shall be replaced by the manufacturer during this three (3) year warranty period at no cost to the Owner. Replacement equipment shall be delivered to the project site. During year one (1) of this warranty period, the contractor shall provide all labor to replace the equipment at no cost to the owner. During years two (2) and three (3) of this warranty period, the Owner will be responsible for the Contractor's labor costs to replace the equipment.

E. The Contractor shall demonstrate that they maintain a service organization capable of providing all necessary service and maintenance of the systems. This includes providing replacement parts and making additions or changes to the software systems used in the project.

F. During the warranty period, all service (including equipment, labor, travel, expenses, etc.) is to 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 provide the Owner a phone response within one (1) business day of receipt of service call. The Contractor shall provide an on-site response time of two (2) business days for system critical items during regular business hours.

G. The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.

H. Provide one routine maintenance visit 6 months prior to and a second visit at the end of the one (1) year 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.

I. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the one (1) year maintenance services contract, 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 GENERAL REQUIREMENTS

A. All products must be new and unused and without blemish or defect.

B. All products used in parts replacement shall meet the specifications for the original equipment.

C. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

D. 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.

E. The contractor shall download and install the most current “stable” firmware version from the manufacturer’s website for each device and piece of equipment (where applicable).

2.2 PRODUCTS

A. See drawings for equipment list(s) which provide the description, manufacturer and part number for each audio/visual (AV) system component.

B. The Contractor may propose alternate components that are equivalent to the specified components. Substitutions will be reviewed in accordance with Specification Section 274100 1.11 listed above. The contractor will be responsible for integrating all specified and alternate system components in accordance with Specification Section 274100 1.8 listed above.

PART 3 -EXECUTION

3.1. INSTALLATION

A. General: Install systems and equipment in accordance with applicable codes. Install equipment in accordance with manufacturer's written instructions. Systems shall be complete and operational in all respects.

B. Coordinate IP addresses and VLANS for equipment requiring network connectivity. Provide the owner with a spreadsheet indicating the name of each piece of network

equipment, the MAC address of the device and the necessary VLAN (control network or LAN). The Owner's IT department will provide the IP addresses and addressing scheme for each device.

C. Provide labels on all AV devices and equipment. Labels shall indicate the name and function of the equipment. Labels shall indicate the IP address(s) of the equipment as applicable.

3.2. A/V SYSTEM TESTING AND COMMISSIONING

A. Test and demonstrate all equipment and system functionality at the completion of the project.

B. Testing and commissioning includes but is not limited to the following:

1. Confirm the installation, mounting and support of all devices and equipment.
2. Verify installation, termination and connection of all A/V cabling.
3. Verify switching and control of all audio and video signals.
4. Verify all audio levels, microphone echo cancellation and feedback elimination.
5. Verify labeling of all equipment and cabling.
6. Verify system control from wireless mobile tablet (where applicable).
7. Verify the documentation of all equipment, devices and cabling in the as-built drawings and O&M manuals.

3.3. 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.

3.4. TRAINING

A. Train Owner's maintenance and operator personnel in the procedures and schedules involved in operating, programming, troubleshooting, servicing, and preventative maintenance of the system. Provide a minimum of 2 hours training during normal business hours for each independent AV system.

B. Training shall be by engineers or technicians highly skilled in the systems and certified by manufacturer as qualified to provide training in the particular systems.

C. Schedule training with the Owner with at least seven days in advance.

D. Contractor to provide sign-in sheet for training attendees.

END OF SECTION 274100

SECTION 274116 – CLASSROOM AUDIO ENHANCEMENT AND SAFETY ALERT 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 and Safety Alert System as shown on the Drawings and described in the Specifications.

B. Section Includes:

1. School-wide safety alert system and classroom audio enhancement system including: DECT RF based receivers, network attached amplifiers, wireless microphones, speakers, ceiling enclosures, system controller and alarm notification device.
2. This is an equipment specification for the Owner to purchase and furnish this equipment to the Contractor. See drawings for a complete listing of Owner furnished and Contractor installed equipment. The Contractor is responsible for installing, cabling, configuring, programming, adjusting, tuning, testing and demonstrating all equipment.

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, 2017 -- 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, Contractor shall furnish a complete Audio Enhancement and Safety Alert System as shown on the drawings. Each system shall include but not be limited to:

1. One Dual Channel DECT microphone receiver.
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. The classroom amplifier must have a PoE network connection for transmission of safety alerts.
6. System must provide DECT wireless transmission of AV sources from a mobile display to receiver.
7. Four (4) ceiling speakers for each classroom. Additional speakers will be supplied by the vendor as necessary to provide complete even coverage throughout each educational space
8. One (1) Wall Enclosure with power and data for mounting of IP based amplifier and microphone receiver. Enclosure to be provided by the owner and installed by the Contractor

B. SAFE Server.

1. Provide system administration and management server as part of the teacher personal alert system. The server shall be rack mounted and connected to a battery backup.
2. The SAFE Server shall periodically poll every device, which is part of the SAFE System. It shall monitor every device on a schedule not to exceed 200 seconds.
3. The SAFE Server shall maintain a log of all network transactions, including failed polling of a device.
4. The SAFE Server shall manage all network transactions regarding the SAFE System. The Controller shall be responsible for alerting the Safe monitoring workstation computer when an alert has occurred.

5. The SAFE System Server shall provide a robust e-mail service, which will allow the unit to notify appropriate response personnel when an alert occurs, or when part of the SAFE System is offline.

C. SAFE Monitoring Workstation Computer.

1. Provide an alert system computer for the front office of the school. The computer shall have the following features:

a. Capable of receiving and distinguishing messages from every classroom alert system in the school.
b. Computer shall graphically display location of classroom alarms and shall provide video from the Educam located in the room.
c. Connections:

(1) 120 Volts Power
(2) Network Connection

D. 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.

E. 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.

F. 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.

G. 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.

H. 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.

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, Contractor shall furnish a complete Audio Enhancement and Safety Alert System as shown on the drawings. Each system shall include but not be limited to:

1. One Dual Channel DECT microphone receiver. Receiver shall be mounted on the ceiling enclosure door.
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. Four (4) ceiling speakers for each classroom. Additional speakers will be supplied by the vendor as necessary to provide complete even coverage throughout each educational space.
8. 12MP 360 degree ceiling mounted camera.
9. One (1) Wall Enclosure with power and data.

B. 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

C. 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

D. 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

E. Dual microphone charger specifications:

1. Provide a Dual USB Charger
2. Provide a Micro USB to USB-A cable for each microphone

F. 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)

G. 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

H. Wall Enclosure specifications

1. Provide a wall enclosure that is sized appropriately to accommodate the amplifier and microphone receiver in each classroom

2.3 SAFETY ALERT SYSTEM SERVER

A. SAFE System SERVER

1. Provide a system administration and management server as part of the teacher personal alert system. This server shall be rack mounted in the main telecom room and connected to the network.

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. Washoe County School District will 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.

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: Wireless 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. Record Drawings: Prior to final acceptance, provide three (3) complete sets of drawings 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. Wireless Clock System

1. 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.
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 Wireless System consists of a master transmitter located on the inside of the building, and a NTP receiver connected to a time server. Wireless 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. Analog Clocks may be battery operated for full portability if required.
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. Battery Powered Analog Clocks shall require 2 “D” cell batteries.
13. 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.
14. The wireless backbone must support expansion of the system to include wireless alphanumeric displays for emergency crisis communications for district-wide communications.
15. 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.
16. The system shall lend itself to expansion by simple addition of wireless secondary clocks and their required power source.

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 275113

SECTION 275129 - EMERGENCY COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the emergency 2-way communication system between the 2nd floor elevator landing and the main entry administrative office, and to ensure that it is in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

B. This section includes minimum requirements for the following:

1. Flush Mounted Master Station located in Administrative Office.
2. Master Station recess wall mount kit.
3. Master Station power supply.
4. Master Station battery backup.
5. Elevator landing flush mount emergency call station with clear cover.
6. Elevator landing call station recess mount kit.
7. Area of Rescue sign.
8. Plenum rated shielded 22/4 twisted pair communication cabling between master station and call station.
9. Plenum rated 18/2 power cabling between master station and call station.
10. Installation, configuration and commissioning of system.
11. Testing and demonstration of the system to the local Fire Marshall or local Fire Code Official.

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

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 CERTIFICATIONS AND STANDARDS

A. The command unit shall be designed to meet the following standards:

1. Accessibility

a. ADA: Standards for Accessible Design – 2010 §7
b. ANSI ICC A117.1 (2009): Accessible and Usable Buildings and Facilities
c. IBC (2018) §1009
d. NFPA 72: National Fire Alarm and Signaling Code – 2016 §24.10

2. Safety

   a. UL 60950-1

3. Direct connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN)

   a. FCC (47 C.F.R. Part 68)

1.4 QUALITY ASSURANCE

A. All command unit installation, configurations, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.

B. All equipment shall be warrantied against any defects in material and workmanship under normal use for a period of twenty-four (24) months from date of installation, provided that manufacturer receives a completed "Installation Certification" certifying the date on which the system has been installed. An "Installation Certification" card shall be enclosed with every unit. In the event that no "Installation Certification" is received by manufacturer, the twenty-four (24) months will commence on the date of shipment by the manufacturer.

1.5 SUBMITTALS

A. Submit manufacturer product data sheets for all system components and cabling.

B. Product Data Sheet Submittals shall comply with the following:

1. Product data submittals must be submitted to and approved prior to release of order for equipment and prior to installation.
2. Submit product data sheets in PDF format.
3. Submittals must include all items identified in each specification section. Partial submittals will not be accepted.
4. Where product data sheets cover more than one distinct item, clearly indicate by arrows or brackets precisely what is being submitted including optional accessories. Delete or cross-out non-applicable data.

C. Shop drawings:

1. Submit shop drawings for all equipment showing:

   a. Location and layout of all field devices.
   b. Location and layout of all equipment.
   c. Oneline wiring/cabling diagrams for devices, equipment and components. Oneline diagrams shall identify all devices and equipment and shall include all interconnecting wiring, cable types and sizing. Provide manufacturers wire/cable type as required.
   d. Elevations of all equipment mounting enclosures showing equipment mounting locations, electrical outlet locations, termination equipment.
   e. Drawings for each field device type detailing wiring and mounting instructions.
   f. Point-to-point wiring data, utilizing a combination of AutoCAD generated drawings and device/equipment Excel schedules.

D. Calculations:

1. Battery Backup Calculations:

    a. Provide battery backup calculations to verify that uninterruptable power supplies are sized to provide backup of the entire 2-way communications system for a duration of not less than 4 hours.

E. Operation and Maintenance Manuals

1. Format:

    a. PDF.

2. Content:

    a. Functional Design Manual: Includes a detailed explanation of the operation of the system.

3. Hardware Manual which includes:

    a. Pictorial parts list and part numbers.
    b. Pictorial and schematic electrical drawings of wiring systems, including devices and equipment.
    c. Telephone numbers for the authorized parts and service distributors.
    d. Include all service bulletins.

4. Operator's Manual which full explains all procedures and instructions for the operation of the system and includes:

    a. System start up and shut down procedures.
    b. Use of system.
    c. Equipment recovery and restart procedures.
    d. Software and firmware backup procedures (where applicable).

5. Maintenance Manual which includes:

    a. Manufacturer's warranty certificates.

PART 2 - PRODUCTS

2.1 GENERAL

A. The command unit shall:

1. Be an indoor-rated emergency communications system device comprised of a local command unit phone, a monitoring panel and an uninterruptible power supply (UPS).
2. Be programmable through the local command unit phone.
3. Be programmable from a remote location if a connection to the public switched telephone network (PSTN) is made available.
4. Support and provide power to each analog call station for up to five (5) units as an area of rescue assistance station used for emergency communications.
5. Provide analog call stations with the ability to establish communication with either an attendant at the local command unit phone or an attendant through a PSTN connection.

6. Provide an audible and visual indication of a system ground fault.
7. Provide an audible and visual indication of open faults and short faults that occur on an analog call station conductive pathway.
8. Have a monitoring panel that provides a visual indication on the activation status and trouble status of the analog call stations.

2.2 HARDWARE

A. The command unit enclosure shall:

1. Be constructed of 16 Ga. cold-rolled steel (CRS).
2. Be powder coated black with a textured finish.
3. Have mounting holes on the rear and two sides of the enclosure.
4. Have multiple 3/4" and 1” conduit knockouts for wiring access.
5. Have a hinged door.

B. The local command unit phone compartment shall:

1. Have a door with a magnetic latch.
2. Have a door with an acrylic window so that the local command unit phone light-emitting diodes (LEDs) are visible.

C. The command unit shall have a monitoring panel to provide a visual indication on the activation status of analog call stations. The monitoring panel shall:

1. Have one (1) LED for each analog call station to indicate activation status.
2. Have one (1) LED for each analog call station to indicate trouble status in the event an open fault or a short fault occurs on an analog call station conductive pathway.
3. Have one (1) LED to indicate the power status.
4. Have one (1) LED to indicate the status of a connection to the PSTN.
5. Have one (1) LED to indicate the status of a connection to the local command unit phone.
6. Have one (1) LED to indicate a fault when there is a loss in primary power provided to the UPS.
7. Be protected by an acrylic window.

D. The local command unit phone shall:

1. Have a handset with a coiled cord.

2.3 FUNCTIONALITY

A. Local Command Unit Phone

1. Receive calls from one (1) of five (5) analog call stations.
2. When an incoming call has been received, the local command unit phone shall audibly ring.
3. When an incoming call has been received, the assigned line indicator button LED shall illuminate and flash.
4. Originate calls selectively to one (1) of the five (5) analog call stations.

B. Call Routing

1. The command unit shall be configurable with the following call routing procedures:

a. Route calls to the local command unit phone as primary, PSTN connection as secondary;
   (1) First, route a call to the local command unit phone.
   (2) Secondly, if there is no answer or there is a busy signal from the local command unit phone, then route a second call to the local command unit phone.
   (3) Thirdly, if there is no answer or there is a busy signal from the local command unit phone, then route a third call through a PSTN connection.
   (4) Fourthly, if there is no answer or there is a busy signal from the PSTN connection, then route a fourth call through a PSTN connection.
   (5) Finally, if there is no answer or there is a busy signal from the PSTN connection, then continue routing the call in order and as described in the aforementioned cycle until the call is answered or the call conversation timer expires.

2. The command unit shall be capable of queueing calls on a “first in, first out” (FIFO) basis.

   a. When a call is in session, subsequent calls shall be placed into a FIFO queue.
   b. When a call is completed, the next call in queue shall be automatically placed to either an attendant at the local command unit phone or an attendant through a PSTN connection.

3. When the attendant terminates a call, the analog call station shall automatically return to an on-hook condition.

C. Visual Indicators (Monitoring Panel)

1. Power Status LED

   a. When the command unit is powered, the power status LED shall be solidly illuminated.
   b. When there is a power fault, the power status LED shall be unlit.

2. Analog Call Station LEDs

   a. When an analog call station has been activated but not connected to either an attendant at the local command unit phone or an attendant through a PSTN connection, the respective analog call station LED shall be solidly illuminated.
   b. When an analog call station has been activated and the call has been answered by either an attendant at the local command unit phone or an attendant through a PSTN connection, the respective analog call station LED shall be solidly illuminated.
   c. Queued calls shall be indicated through the respective flashing analog call station LED.

3. Trouble LEDs

   a. When an open fault or short fault occurs on an analog call station conductive pathway, the respective trouble LED shall be solidly illuminated.

b. When a system ground fault occurs, all trouble LEDs shall flash simultaneously.

4. PSTN LEDs

a. When there is a call connection attempt through the PSTN port, the PSTN LED shall flash.
b. When there is an active call connection through the PSTN port, the PSTN LED shall be solidly illuminated.

5. Local Command Unit Phone LEDs

a. When there is a call connection attempt through the local command unit phone port, the local command unit phone LED shall flash.
b. When there is an active call connection through the local command unit phone port, the local command unit phone LED shall be solidly illuminated.

6. Primary Power Status LED

a. When there is a loss in primary power provided to the UPS, a dedicated LED shall be solidly illuminated.

2.4 INTERFACES

A. Analog Call Station Interface

1. Each command unit shall be equipped with five (5) analog call station ports in order to support up to five (5) analog call stations.
2. The command unit shall be equipped with a terminal block for the analog call station interface.

B. Public Switched Telephone Network (PSTN) Interfaces

1. The command unit shall be equipped with one (1) PSTN port.
2. The PSTN port shall interface through a terminal block.

2.5 POWER REQUIREMENTS

A. The command unit shall be powered by a built-in Uninterruptible Power Supply (UPS).

B. The command unit UPS shall:

1. Be powered by a primary power source.
2. Provide up to four (4) hours of backup time in the event of power source failure.

2.6 ACCEPTABLE PRODUCTS

A. Master Station Command Unit: Rath SmartRescue 5 P/N 2500-205FM.
B. Elevator Landing Call Station: Rath P/N 2100-958SSRC2.
C. Elevator Landing Signage: Rath P/N 7049SS.
D. Plenum rated shielded 22/4 twisted pair audio cable: Belden P/N 6502UE.
E. Plenum rated 18/2 power cable: Belden P/N 6300UE.
F. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installer shall carefully follow instructions in documentation provided by the manufacturer to ensure all steps have been taken to provide a reliable, easy-to-operate system.

B. All equipment shall be tested and configured in accordance with instructions provided by the manufacturer prior to installation.

C. Test and demonstrate the system to the local Fire Marshall or local Fire Code Official.

D. The master station command unit shall support flush recess wall mounting.

END OF SECTION 275129

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.

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 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 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 insure 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 of 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 fail safe 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 wiring in raceway except within consoles, desks, and counters, and except in accessible ceiling spaces, and in gypsum board partitions, where cable wiring method may be used. Use UL listed plenum cable in environmental air spaces including plenum ceilings. Conceal wiring except in unfinished spaces.

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. 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 COMMISSIONING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the clock system. Provide a minimum of 2 hours training. Operators Manuals and Users Guides shall be provided at the time of this 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 27 53 19 – EMERGENCY RESPONDER RADIO SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Project includes installation of an Emergency Responder Radio Communication Systems (ERRCS).

B. Provide all labor, materials, equipment, tools, transportation, storage costs, permits, programming, testing, adjusting, tuning and all necessary and related items as required to provide complete and operational ERRCS as shown on the Drawings and described in the Specifications.

C. Contractor shall be responsible for the design, installation, testing and certification of the new ERRCS in accordance with the following codes:

1. 2017 National Electric Code (NEC)
2. 2018 International Fire Code (IFC) - Section 510.
3. 2022 NFPA 1225 Standard for Emergency Services Communications - Chapters 18 and 20.

D. Contractor shall submit a deferred permit submittal to the local Fire Code Official for review, approval and permit.

E. ERRCS shall be compatible with and shall communicate with the Washoe County Regional Communication System (WCRCS).

F. ERRCS shall use a channelized Class "A" Building Distribution Amplifier (BDA). The system must be compatible with both Harris P25 Phase 1 and P25 Phase 2 for all channels.

G. ERRCS shall provide coverage in the 700MHz-800MHz frequency bands as specified by the WCRCS. System shall be expandable to operate on the FirstNet 700 MHz National Public Safety Broadband Network frequencies 758-768/ 788-798MHz.

H. The downlink from the WCRCS shall include the following two passbands, 769 to 775MHz and 851 to 861MHz. The uplink to the WCRCS shall include 799 to 816MHz.

I. The remote radio tower site and orientation of the donor antenna shall be determined and coordinated with the WCRCS Radio Division. Donor antenna shall maintain isolation from the in-building distributed antenna system and shall be 15db minimum above the signal booster gain under all operating conditions.

J. Provide Uninterruptable Power Supplies (UPS’s) to backup the entire Emergency Responder Radio System for a duration of not less than 12 hours in accordance with 2018 International Fire Code Section 510.4.2.3.

K. All Emergency Responder signal booster components and UPS’s shall be mounted in NEMA 4 or NEMA 4X type waterproof enclosures in accordance with 2018 International Fire Code Section 510.4.2.4.

L. Antenna cabling routed within the building from the building distribution amplifier (BDA) to the roof mounted donor antenna shall be 2-hour rated.

M. Antenna cabling routed exterior to the building on the roof from the BDA to the donor antenna shall be outdoor rated and routed in conduit.

N. ERRCS equipment and battery systems shall be electronically monitored by a dedicated annunciator panel located adjacent to the existing fire alarm control panel per 2022 NFPA 1225 section 8.14.2.

O. ERRCS equipment and battery systems shall be electronically supervised by the fire alarm system per 2022 NFPA 1225 section 8.14.1.

P. At a minimum, the Contractor shall furnish and install the following Emergency Radio System components:

1. Roof mounted 700/800 MHz yagi donor antenna.
2. Roof mounted donor antenna non-penetrating galvanized steel support mast and frame. Provide 3/8” thick pad below support frame. Provide ballast as required.
3. Sealed roof penetrations.
4. Outdoor rated antenna cabling routed on the roof from the donor antenna to the roof penetration. Outdoor cable to be routed in conduit.
5. 2-hour rated plenum antenna cabling routed within the building from the BDA to the roof.
6. Bonding and grounding equipment including isolated ground bar, antenna cable shield ground kit, surge protector (PolyPhaser), and related bonding/grounding conductors.
7. Class “A” channelized building distribution amplifier (BDA) wall mounted in NEMA 4 or 4X enclosure. BDA to have alarm contacts monitored by a dedicated annunciator panel. BDA cabinet to be bonded to the ground bar with #6 green insulated bonding conductor.
8. Dedicated Emergency Responder Radio System annunciator panel mounted adjacent to the main fire alarm control panel (FACP). Multi-pair cable from annunciator panel to BDA.
9. Sign at FACP stating: "This building is equipped with an emergency responder radio coverage system". Sign shall be red with 1" high white letters.
10. Fire alarm supervision of all “points” monitored by the dedicated annunciator panel.
11. 50-Ohm ½” diameter plenum rated coax antenna distribution cabling and related raceway, boxes, supports, connectors, directional couplers and taps. Provide fire stop assemblies at penetrations through rated walls and floors. Coax cabling routed in accessible ceiling spaces shall be supported by j-hooks. All exposed coax cabling to be routed in EMT conduit (no exposed cabling is permitted).
12. Provide outdoor rated 50-Ohm coax antenna distribution cabling where routed in underground conduit.
13. Coax taps, directional couplers and attenuators.
14. 120VAC to 48VDC batter backups mounted in NEMA 4 or 4X enclosures capable of backing up all equipment for a minimum of 12 hours. Battery backups to have alarm contacts monitored by a dedicated annunciator panel. UPS cabinets to be bonded to the ground bar with #6 green insulated bonding conductor.
15. Surface ceiling or wall mounted indoor 700/800 MHZ omni-directional antennas.
16. Miscellaneous Equipment interconnect jumper cables as required.

Q. At the completion of the project, the contractor shall verify minimum radio signal strength and delivered audio quality (DAQ) inside the building. Acceptance tests shall be conducted in accordance with 2018 IFC Section 510.5.3, 2022 NFPA 1225 sections 18.9 and 20.

R. Contractor shall provide a system certification report in PDF format. Report shall be submitted to the Owner and posted at the fire alarm control panel (FACP). Report shall include the following information:

1. Test procedure.
2. Test equipment used.
3. Certificate(s) of test equipment calibration
4. Floor plans divided into grids indicating radio signal strength/DAQ with pass/fail results.
5. Certified cable sweep test results.
6. Pictures of electronic equipment.
7. Equipment configuration settings.

S. Final acceptance, approval and permit sign off are required in writing from the local Fire code official Department prior to contract closeout.

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 28: Interior Communications Pathways.

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, 2017 -- National Electrical Code (NEC).
2. NFPA-72, 2019 – National Fire Alarm And Signaling Code.
3. NFPA-1225, 2022 – Standard for Emergency Services Communications.
4. 2018 International Fire Code.
5. FCC Regulations:
   a. Part 15 – Radio Frequency Devices & Radiation Limits
   b. 47 CFR Part 90.219.
6. Underwriter’s Laboratories, Inc. (UL).
7. Electronic Industry Association (EIA) testing standards
8. American Standard Code for Information Interchange (ACSI)
9. American Society for Testing and Materials (ASTM)
10. National Electrical Manufacturers' Association (NEMA)

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:

1. The minimum qualifications of the system designer and lead installation personnel shall include both of the following in accordance with 2018 International Fire Code Section 510.5.2:

    a. A valid FCC-issued general radio operators license.
    b. Certification of in-building system training issued by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed.
    c. The above qualifications shall not be required where demonstration of adequate skills and experience satisfactory to the fire code official is provided.

2. The contractor shall be licensed by the Nevada State Contractors Board.
3. The Contractor shall have a minimum of five (5) years experience in the installation, integration and testing of Emergency Responder Radio Systems of similar size and scope.
4. The Contractor shall be a firm normally engaged in the design, installation and maintenance of Emergency Responder Radio Systems. The Contractor shall provide details of at least three (3) projects of similar size and scope involving the design, installation and testing of Emergency Responder Radio Systems in the last 5 years. Names, addresses and telephone numbers of references for the three projects shall be included.
5. The Contractor shall have service facilities within 4 hours of the project site and shall respond to service phone calls within one (1) business day of receipt. The Contractor shall provide an on-site response time of three (3) business days for critical system items during regular business hours.

B. UL Listing and Labeling: Unless specific equipment specified within the radio system Specifications is not listed or labeled by UL, provide components listed and labeled by UL.

C. All work shall conform to the National Electrical Code (NEC) and to applicable National Fire Protection Association (NFPA) and International Fire codes.

D. Compliance with Local Requirements: Comply with the applicable building code, state and local ordinances, and regulations and the requirements of the authority having jurisdiction.

E. All equipment supplied shall be listed by a nationally recognized test laboratory where applicable.

F. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

G. All items of a given type shall be the products of the same manufacturer.

H. All items shall be of the latest technology; no discontinued models or products are acceptable.

I. The manufacturer, or their Authorized Representative, shall confirm that within 300 miles of the project site there is an established agency which:

1. Stocks a full complement of parts.
2. Offers service during normal working hours as well as emergency service on all equipment to be furnished.
3. Will supply parts and service without delay and at reasonable cost.

4. Contractor shall be capable of performing service or maintenance work on these specified or accepted systems. Contractor shall be factory-certified where such certification is available or required.

1.5 INTENT OF DRAWINGS

A. Layout: Follow the general layout shown on the Drawings except where other work may conflict with the Drawings.

B. Accuracy: The Drawings show a diagrammatic representation of the system. Field verify all dimensions and locations.

1.6 REVIEW OF SPECIFICATIONS

A. 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. 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.

1.7 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 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.

1.8 SUBMITTALS

A. Submit manufacturer product data sheets in electronic PDF format for all system components and cabling.

B. Product Data Sheet Submittals shall comply with the following:

1. Product data submittals must be submitted to and approved by the Owner prior to release of order for equipment and prior to installation.
2. Provide the following information in the submittal:
   a. Client Name.
   b. Project Number and Contract Number.
   c. Project Name and Address.
   d. Contractor's Submittal Number.
   e. Submittal Title.
   f. Specification Section Number.
   g. Date of Submittal.
   h. Contractor Name and contact information.
3. Provide a table of contents indicating the products submitted.

4. Products listed in the table of contents should be in the same order as they appear in the Specifications.
5. Submittals must include all items identified in each specification section. Partial submittals will not be accepted.
6. Where product data sheets cover more than one distinct item, clearly indicate by arrows or brackets precisely what is being submitted including optional accessories. Delete or cross-out non-applicable data.

C. Shop drawings:

1. Shop drawings generated for this project shall be created utilizing AutoCAD 2018 or newer file format.
2. Drawings shall be drafted on 24” x 36” sheets to match the contract drawings.
3. Submit shop drawings for all equipment showing:
   a. Location and layout of all field devices including donor antennas, omni-directional antennas, directional couplers and taps.
   b. Location and layout of all equipment including building distribution amplifiers, remote units, surge protectors, uninterruptable power supplies, annunciator panel, etc.
   c. Oneline wiring/cabling diagrams for devices, equipment and components. Oneline diagrams shall identify all devices and equipment and shall include all interconnecting wiring, cable types and sizing. Provide manufacturers wire/cable type as required.
   d. Block diagram(s) depicting system integration details including fire alarm monitoring locations.
   e. Elevations of all equipment mounting enclosures showing equipment mounting locations, electrical outlet locations, termination equipment.
   f. Drawings for each field device type detailing wiring and mounting instructions.
   g. Point-to-point wiring data, utilizing a combination of AutoCAD generated drawings and device/equipment Excel schedules.

D. Calculations:

1. Building Radio Signal Strength Coverage Calculations:

   a. Provide color “heat maps” indicating required radio signal strength coverage of -95 dBm in 95% of the building in accordance with 2018 IFC Section 510.4.1. Contractor to adjust quantity and location of indoor antennas as required to meet the IFC signal coverage requirements.

2. Donor Antennas Gain and Placement Calculations:

   a. Contractor to measure signal strength from the remote “distant” emergency responder radio site to verify the required gain, placement and aiming of the outdoor donor roof antennas.

3. Battery Backup Calculations:

   a. Provide battery backup calculations to verify that uninterruptable power supplies are sized to provide backup of the entire emergency responder radio system for a duration of not less than 12 hours.

4. RF Cable dB Loss Calculations:

a. Submit RF cable dB loss calculations from the signal amplifiers to the omni-directional distribution antennas. Based on the calculated RF cable and jumper losses, the contractor shall design the required RF cable taps and directional couplers to balance the RF signal strength at each antenna throughout the building. Submit proposed cable taps and directional couplers for approval and provide calculations indicating the resulting signal strength at each indoor omni-directional antenna.

E. Radio System Certification Report:

1. Submit radio system certification report in PDF and printed 8 ½" x 11" format. Report shall be submitted to the Owner and posted at the fire alarm control panel (FACP). Report shall include the following information:

a. Test procedure.
b. Test equipment used.
c. Certificate(s) of test equipment calibration
d. Floor plans divided into grids indicating radio signal strength/DAQ with pass/fail results.
e. Certified cable sweep test results.
f. Pictures of electronic equipment.
g. Equipment configuration settings.

F. Operation and Maintenance Manuals

1. Provide O&M Manuals in PDF format.
2. Include Table Of Contents listing contents.
3. O&M's shall include the following content:
   a. Functional Design Manual: Includes a detailed explanation of the operation of the system.
   b. Operator's Manual which explains procedures and instructions for the operation of the system including:
      (1) System start up and shut down procedures.
      (2) Use of system.
      (3) Equipment recovery and restart procedures.
      (4) Software and firmware backup procedures (where applicable).
   c. Manufacturer's warranty certificates.

G. Record Drawings

1. Content:
   a. Fully represent actual installed conditions and incorporate all revisions made during the course of construction.
   b. Include drawings submitted as part of the Shop Drawing package, plus any additional information required to accurately document installed conditions.
   c. Floor plans shall show:
      (1) Locations and identifiers of all devices.
      (2) Size, quantity, location, and routes of all pathways (such as cable trays, conduits, J-hangers, and other cable support devices).

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery.

1. Do not deliver products to the site until protected storage space is available. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at jobsite.
1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels (name of the manufacturer, product name, type, grade, UL classification, etc.) intact.
2. Replace materials damaged during shipping at no cost to the Owner.

B. Storage.

1. Store materials in clean, dry, ventilated space free from temperature and humidity conditions (as recommended by manufacturer) and protected from exposure to harmful weather conditions.
2. Comply with manufacturer's requirements for each product. Comply with recommended procedures, precautions or remedies as described in the Material Safety Data Sheets (MSDS) as applicable.
3. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic.
4. Storage outdoors covered by rainproof material is not acceptable.
5. Provide heat where required to prevent condensation or temperature related damage.

C. Handling.

1. Handle in accordance with manufacturer's written instructions.
2. Damaged equipment shall not be installed.
3. Replace damaged equipment at no cost to the Owner.
4. Handle with care to prevent internal component damage, breakage, denting, and scoring.

1.10 SUBSTITUTIONS

A. No material substitutions will be allowed except by written acceptance from the Owner’s Representative. 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.

B. Approval of alternate or substitute equipment or material in no way voids the Specification requirements.

C. Under no circumstances shall the Owner’s Representative 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.

1.11 WARRANTY

A. The warranty period will begin after substantial completion of the project.

B. The complete Emergency Responder Radio System including all devices, equipment, 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.

C. Provide maintenance of systems and equipment for a period of one (1) year from date of substantial completion.

D. Emergency Responder Radio System equipment shall have a three (3) year warranty. Defective or damaged equipment shall be replaced by the manufacturer during this three (3) year warranty period at no cost to the Owner. Replacement equipment shall be delivered to the project site. During year one (1) of this warranty period, the contractor shall provide all labor to replace the equipment at no cost to the owner. During years two (2) and three (3) of this warranty period, the Owner will be responsible for the Contractor's labor costs to replace the equipment.

E. The Contractor shall demonstrate that they maintain a service organization capable of providing all necessary service and maintenance of the systems. This includes providing replacement parts and making additions or changes to the software systems used in the project.

F. During the warranty period, all service (including equipment, labor, travel, expenses, etc.) is to 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 provide the Owner a phone response within one (1) business day of receipt of service call. The Contractor shall provide an on-site response time of two (2) business days for system critical items during regular business hours.

G. The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.

PART 2 -PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All equipment shall have FCC certification prior to installation in accordance with 2018 International Fire Code Section 510.4.2.4.

B. All products must be new and unused and without blemish or defect.

C. All products used in parts replacement shall meet the specifications for the original equipment.

D. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

E. 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.

F. The contractor shall download and install the most current "stable" firmware version from the manufacturer's website for each device and piece of equipment (where applicable).

2.2 PRODUCTS

A. See drawings for equipment list which provide the description, manufacturer and part number for each Emergency Responder Radio System component.

B. The Contractor may propose alternate components that are equivalent to the specified components. Substitutions will be reviewed in accordance with the Substitutions section above. The contractor will be responsible for integrating all alternate system components into an overall operational system.

PART 3 -EXECUTION

3.1. INSTALLATION

A. Install systems and equipment in accordance with applicable codes. Install, mount, connect tune, adjust and test all equipment in accordance with manufacturer's written instructions. Systems shall be complete and operational in all respects.

B. Furnish and install in-building ceiling and wall mounted omni-directional antennas as required to meet the signal strength coverage requirements required by Section 510 of the 2018 International Fire Code and 2022 NFPA 1225.

C. Coordinate the mounting of all equipment in the telecommunication and electrical rooms with existing equipment.

D. Install alarm monitoring cabling from the BDA, remote units, power supplies and battery backups to the dedicated annunciator panel.

E. Install cabling from the existing fire alarm control panel to the dedicated annunciator panel to supervise all alarm points. Program existing fire alarm panel as required to supervise alarm points.

F. All roof mounted antenna supports, masts, frames, fasteners, etc. shall be pre-galvanized or hot dipped galvanized steel. Provide pad between support frame and existing roofing surface.

G. Cabling routed within the building from the BDA to the donor roof antenna shall be 2-hour rated.

H. Roof penetrations shall be installed by a certified roofing contractor. The certified roofing contractor shall provide all materials and labor necessary to properly seal all penetrations.

I. Terminate indoor and outdoor coax antenna cabling with "N" type RF connectors.

J. All raceway shall be run perpendicular to building grid lines UON.

K. Install, support and seismic brace all raceway and cabling.

L. Install raceway so that the following minimum clear distances are maintained from sources of electro-magnetic interference (EMI). 6" clear from power cables, 12" clear from fluorescent lighting and 36" clear from transformers and motors.

M. Seal all penetrations through rated walls and floors with UL fire stopping assemblies. Fire stopping assemblies shall be UL listed and shall meet or exceed the rating of the wall or floor being penetrated.

N. Bond and ground all raceways, exterior antennas, antenna supports, exterior antenna cabling, surge arrestors and equipment enclosures.

O. Label all components of the emergency responder radio system. In-building antenna cables shall be labeled at both ends indicating the antenna number and at all pull box locations. All antenna cabling shall be tested and certified.

3.2. SYSTEM TESTING AND COMMISSIONING

A. Test and demonstrate all equipment and system functionality at the completion of the project.

B. The Emergency Responder Radio System shall be tested in accordance with the acceptance test procedure outlined in Section 510.5.3 of the 2018 International Fire Code and Section Chapter 20 of the 2022 NFPA 1225.

C. Submit system certification report to Owner and Fire Code Official. Post copy of report at FACP.

D. Final acceptance and approval are required from the local Fire Code Official in writing prior to contract closeout.

3.3. 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. Top and side panels, and all cabinet doors shall be installed. 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 275319

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 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.
6. Section 28 10 00: Access Control.
7. Section 28 20 00: Video Surveillance.
8. 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, 2011 -- 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. 2002 NFPA 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 all necessary and related items required to provide a complete and operational Access Control, Video Surveillance and Intrusion Detection System Cabling System as shown on the Drawings and described in the Specifications.

B. Provide all necessary wiring, cabling and termination equipment required for the entire Access Control, Video Surveillance and Intrusion Detection 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. 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.
5. Section 28 10 00: Access Control.
6. Section 28 20 00: Video Surveillance.
7. Section 28 30 00: Security Detection, Alarm & 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. NFPA-70, 2011 -- 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 access control door controllers and video surveillance cameras as shown on the Drawings. Category 6 cabling shall be installed, terminated and tested by the Telecom Contractor in accordance with the Division 27 Specifications.

B. All other electronic safety and security cabling shall be routed in conduit. No exposed cabling is permitted. Conduit shall be sized so as not to exceed 40% fill rate. Outdoor exposed conduit shall be rigid or IMC. 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. Indicate the number designated on the associated field or shop drawings or run sheet, as applies. 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.

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

A. 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 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 00 00: Common Work Results for Electronic Safety and Security.
2. Section 28 10 00: Access Control.
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.

1.3 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. American Society for Testing and Materials (ASTM):

a. B1-07 Standard Specification for Hard-Drawn Copper Wire.
b. B3-07 Standard Specification for Soft or Annealed Copper Wire.
c. B8-04 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

a. 81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
b. C2-07 National Electrical Safety Code.

3. National Fire Protection Association (NFPA):

a. NFPA-70, 2011 -- National Electrical Code (NEC).

4. Underwriters Laboratories, Inc. (UL):

   a. 44-05 Thermoset-Insulated Wires and Cables
   b. 83-08 Thermoplastic-Insulated Wires and Cables
   c. 467-07 Grounding and Bonding Equipment
   d. 486A-486B-03 Wire Connectors

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 ground bar. Show the location of equipment to be grounded to the ground bars and the size of the ground conductors. Show the routing and size of ground conductors from the ground bars to electrical panels, building steel, etc.

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).

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.

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: Ground and bond metallic conduit systems as follows:

1. Ground metallic service conduit and any pipes entering or being routed within the computer room at each end using 6AWG bonding jumpers.
2. Bond at all intermediate metallic enclosures and across all joints using 6 AWG bonding jumpers.

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 6 AWG bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 50 feet.
3. Use insulated 6 AWG bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.
4. Use insulated 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 50 feet.

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 Intrusion Detection and Access Control System Cabling as shown on the Drawings and described in the Specifications.

B. Provide a complete end-to-end raceway system for the entire Door Access Control System 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. 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. 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 10 00: Access Control.
4. Section 28 20 00: Video Surveillance.
5. 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:

6. 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 28 10 00 - ACCESS CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes access control field devices, intelligent controllers, power supplies, equipment enclosures, cabling, software and licenses.

1.2 DESCRIPTION OF WORK

A. Washoe County School District has an existing door access control system including head-end server, software and licensing. The existing access control system software is Genetec Security Center v5.6. Washoe County School District has installed the Genetec Synergis Pro Package w/256 readers and 10 clients. The contractor will be responsible for integrating the door access control at this site with this existing system. The contractor shall follow the established naming convention for sites, doors and card holder security groups.

B. Include all equipment, materials, labor and all necessary and related items required to provide a complete and operational access control system as shown on the drawings and described in the specifications.

C. Furnish, install, program and test access control system head-end software, gateways, intelligent controllers, door controllers, I/O boards, add-in boards, power supplies, battery chargers, batteries, relays, software and licensing as identified on the drawings.

D. Furnish and install door access control field devices including POE+ door controllers, card readers, magnetic door position contacts, request to exit motion detectors, etc. as shown on the drawings.

E. Furnish and install a video intercom system for the main exterior entry door including door station and master station. Install cabling and program the door access control system as required to allow the video intercom master station to unlock the electrified door hardware at the main exterior entry door.

F. Furnish and install access control for the interior single point of entry door including manual push button door release, wireless push button door release, wireless receiver and interface with the electrified door hardware.

G. Prep existing door frames to receive access control devices.

H. Electrified door hardware including electric strikes, power transfer hinges and electric locks are specified in the Architectural door hardware schedule and installed by the door hardware contractor. The Division 28 contractor is responsible for connecting the electrified door hardware to the access control system. Coordinate installation and connection of power supplies and electrified door hardware with the door installer.

I. Furnish, install, terminate and label signal and power cabling for all door access control devices.

J. Furnish and install end-to-end raceway system for access control cabling.

K. Furnish and install Category 6 network cabling to the POE+ based door controllers located above the doors. Network cabling to be installed and tested in accordance with

the Division 27 specifications. POE+ network switches will be provided, installed and programmed by the Owner.

L. Configure existing access control system head-end software and licensing to integrate access control system installed at the elementary school.

M. Assign Microsoft Active Directory group security accounts to local door controllers as directed by WCSD.

N. Furnish, install and configure access control software and access control software licenses as described in these specifications. Provide training to the Owner on the use of the software.

O. Furnish, install and configure access control monitoring software on (1) client workstation as directed by the Owner. Provide training to the Owner on the operation of the monitoring software and printing reports.

P. Furnish and install relays, input devices and cabling to interface the access control system panel with the existing fire alarm system. In the event of a fire alarm, egress doors shall fail open.

Q. Perform system testing and commissioning of all security devices shown on the drawings.

R. Meet with the Owner to determine the required operation and functionality of the system. Program the security system in accordance with the Owner's requirements including user/group access rights and schedules on a per door basis.

S. Demonstrate the entire security system to the Owner at the completion of the project. Provide four (4) hours of training to the admin staff on the operation and maintenance of 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 Back Boxes for Electronic Safety and Security.
5. Section 28 05 53: Identification for Electronic Safety & Security.
6. Section 28 30 00: Security Detection, Alarm & Monitoring.

C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

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 security industry, as well as federal, state and local governmental agencies, including, but not limited to the following

1. ANSI/NFPA-70, 2011 -- National Electrical Code (NEC).
2. Underwriter's Laboratories, Inc. (UL) 294 – Access Control Systems.
3. Underwriter's Laboratories, Inc. (UL) 1076 – Burglar Alarm and Systems.
4. Federal Communications Commission (FCC).
5. Americans with Disabilities Act (ADA).

1.5 CONTRACTOR QUALIFICATIONS

A. The Contractor installing the access control system shall have a minimum of five (5) years experience installing access control systems of similar size and scope.

B. The Contractor installing the access control 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 shall be a Genetec Certified Partner and have the necessary certifications to purchase, install and configure the specified access control system equipment and software.

D. The Contractor's system programmer shall have attended manufacturer training and obtained certification in Genetec™ Security Center - Synergis™ Technical Certification.

E. Contractor must be capable of responding to service calls within four (4) business hours of receipt and providing an onsite response time of one (1) business day for repair of critical system items.

F. The Contractor must be licensed by the Nevada State Contractors Board.

G. Formal, written evidence of the following may be requested at any point during the Bid or installation:

1. If requested, the Contractor, including any subcontractor, shall show proven expertise in the implementation of access control projects. This expertise can be illustrated through the inclusion of details of at least three (3) projects involving the design and installation of access control systems within the past three (3) 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.

1.6 SUBMITTALS

A. Manufacturer's Data Sheets: Submit manufacturer's data sheets in electronic PDF format for the following items:

1. Access control system equipment enclosures.

2. Access control system gateways, intelligent controllers, POE+ based door controllers & I/O boards.
3. Relays.
4. Power supplies & battery chargers.
5. Batteries.
6. Contactless smart card readers.
7. Card stock.
8. Magnetic door position contacts.
9. Request to exit motion detectors.
10. Manual door release push buttons.
11. Wireless door release pendants and wireless receivers.
12. Main entry door video intercom door station and admin console.
13. Kitchen delivery door call button and remote door chime.
14. Access control system software and licenses.

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 in electronic PDF format that include the following items:

1. Submit floor plans indicating all security devices installed at each door.
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 door security devices, power supplies, relays, card reader panels, security panel I/O boards, battery backups, etc.
4. Submit layout drawings of the components mounted in the equipment enclosures located in the telecom rooms including system controllers, card reader boards, I/O boards, relays, power supplies, battery chargers, cable management wireways, overhead gutters, data outlets, electrical outlets, etc.
5. Submit security panel battery calculations (batteries shall backup the entire system for a minimum of 4 hours).

D. Naming Convention Scheme for Access Control Doors and Security Groups:

1. Contractor to submit a naming convention scheme for the site, doors and card holder security groups. Naming convention shall match existing. The proposed naming scheme to be reviewed and approved by School Police prior to implementing.

1.7 DELIVERY, STORAGE & HANDLING

A. Protect all controllers, devices and equipment from moisture, dust and debris prior to installation.

1.8 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 Door Access Control 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 Access Control 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) years 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. Equipment Warranty: The Access Control System equipment shall carry a one (1) year manufacturer warranty. Damaged or defective equipment shall be replaced by the manufacturer during this one (1) year warranty period at no cost to the Owner.

5. Software Warranty: The Access Control System software and licenses shall carry a five (5) year manufacturer warranty. During the warranty period, the manufacturer shall provide telephone based technical support and shall provide software upgrades free of charge.

6. Warranty Exclusions: The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.

PART 2 – PRODUCTS

2.1 ACCESS CONTROL SYSTEM EQUIPMENT ENCLOSURES

A. Provide minimum 36” wide x 36” high x 8” deep equipment enclosure where shown on the drawings.

B. Provide a separate lockable equipment enclosure to house the batteries and power supplies immediately adjacent or below the security panel.

C. Equipment enclosures shall have a lockable hinged door. Lock shall be keyed alike with other security enclosures on the project.

D. Install plastic slotted duct to route cabling within the enclosure.

E. Ground security equipment enclosures to ground bar in telecom room with #6 green insulated ground conductor.

F. Label outside of enclosure with an engraved plate.

G. Provide the following accessories inside the enclosures.

1. Tamper switch on each equipment enclosure door.
2. 5” electric fan with thermostat to cool enclosure.

H. Acceptable Products:

1. Hoffman Concept CSD36368 Enclosure, CP3636 Panel, A4AXFNGQ Fan, ABRKT4 Fan Mounting Bracket and ATEMNO Thermostat.
2. Or Approved Equal.

2.2 ACCESS CONTROL SYSTEM GATEWAY APPLIANCE, INTELLIGENT CONTROLLER AND I/O BOARDS

A. Furnish and install site gateway, intelligent controller and input/output (I/O) boards as shown on the drawings. Devices will control all doors with access control on the project.

B. Mount all devices in the equipment enclosure located in the main telecom room.

C. Gateway and intelligent controller shall be assigned IP addresses as directed by WCSD IT department. Contractor will be responsible for providing a list of devices requiring an IP address including a description of the device, its location, MAC address and patch panel port that it is connected to.

D. Configure gateway appliance to communicate with the remote access control system head-end server software. Configure intelligent controller to communicate with the site gateway appliance and the local POE+ based door controllers at each site.

E. Intelligent controllers shall meet the following physical specifications

1. UL 294 recognized.
2. CE Compliant
3. NIST Certified Encryption
4. Manages up to 64 Card Readers.
5. 2 onboard reader ports.
6. 4 Form C Relays, 5A 30VDC output.
7. 1 Ethernet connection.

F. Acceptable Products:

1. Site gateway appliance (Provide 1 gateway per site):

a. Synergis Cloud Link Appliance (Genetec P/N SY-CLOUDLINK).
b. No Substitutions.

2. Intelligent Controller (Provide 1 controller per site):

a. Mercury Security P/N SY-LP1502.
b. No Substitutions.

3. 16-Input Card (Provide 1 input card per site):

a. Mercury Security P/N SY-MR16IN-S3.
b. No Substitutions.

4. 16-Output Card (Provide 1 output card per site).

a. Mercury Security SY-MR16OUT-S3.
b. No Substitutions.

2.3 POE+ DOOR CONTROLLERS

A. Provide POE+ based door controllers where shown on the drawings.

B. Door controllers shall be installed in a lockable enclosure above each door. All enclosures to be keyed alike.

C. Provide plenum CAT 6 network cable from each POE+ door controller to the telecom serving the area. Category 6 cable shall be installed, terminated and tested in accordance with the Division 27 specifications.

D. POE+ based door controllers shall be assigned IP addresses as directed by WCSD IT department. Contractor will be responsible for providing a list of devices requiring an IP address including a description of the device, its location, MAC address and patch panel port that it is connected to.

E. Configure POE+ door controllers to communicate with the intelligent controllers at each site.

F. POE+ door controllers shall have the following physical characteristics:

1. UL 294 recognized.
2. CE Compliant.
3. NIST Certified Encryption.
4. 1.25 Amp Power at Door for card reader, lock and REX.
5. 1 Ethernet Port.
6. 2 card reader ports (controls up to 2 readers at 1 door).
7. OSDP Protocol between reader and controller.
8. Local cardholder database with 240,000 cardholder capacity.

G. Acceptable Products:

1. POE+ Door Controller:

   a. Mercury Security P/N LP1501.
   b. No Substitutions.

2. POE+ Door Controller (at qty (2) Main Entry A101 Doors):

   a. Mercury Security P/N MR62E.
   b. No Substitutions.

3. Lockable Enclosure for POE+ Door Controller:

   a. Life Safety Power FlexPower E5M Enclosure.
   b. Or Approved Equal.

2.4 RELAYS

A. Provide DIN rail mounted relays for all equipment requiring relay activation. Mount relays in lockable equipment enclosures.

B. Provide 24V plug-in type relays with LED lights that indicate when the relay is energized.

1. Acceptable Manufacturers:

   a. IDEC.

b. Or Approved Equal.

2.5 POWER SUPPLIES & BATTERY CHARGERS

A. Provide UL listed supervised power supplies for access control equipment located in the main telecom room including intelligent controllers, gateways, I/O boards, etc. Provide quantity of power supplies to accommodate all equipment.

B. Power supply input shall be 120v. Output shall be 12V or 24V as required by the specific equipment.

C. Power supplies shall have integrated battery charger.

D. Mount power supplies / battery chargers in lockable enclosures.

1. Acceptable Products:

a. Altronix Maximal 11E. Size as required to accommodate all devices.
b. Or Approved Equal.

2.6 BATTERIES

A. Provide UL listed rechargeable batteries to backup all security power supplies. Mount batteries in power supply enclosure.

B. Provide 12V 12Ah, leak proof lead acid batteries.

C. Batteries shall be equipped with safety release valves designed to operate between and 2 and 5 psi and shall automatically reseal.

D. The Contractor shall perform calculations to determine the number of batteries required to backup each power supply. In the case of a power failure, the batteries shall provide a minimum of 2 hours of continuous backup for the entire door access control system.

E. Note – POE+ based door controllers to be backed up by UPS's connected to the POE+ switches in the telecom rooms. POE+ switches and UPS's will be provided and installed by the Owner.

F. Acceptable products:

1. Altronix BT1212.
2. Or Approved Equal.

2.7 CONTACTLESS SMART CARD READERS

A. Provide contactless smart card readers as shown on the drawings.

B. Readers shall be color black.

C. Provide narrow mullion mount readers where required at storefront doors.

D. Provide readers with a 12V operating voltage and 4" read range.

E. Readers shall communicate via the OSDP protocol.

F. Connect card readers to the POE+ based door controller located above each card reader door.

1. Acceptable Products:

a. Standard Size Readers:

(1) HID Signo 40 (verify compatibility with existing HID iClass SE readers installed throughout the district).
(2) No Substitutions.

b. Narrow Mullion Mount Readers:

(1) HID Signo 20 (verify compatibility with existing HID iClass SE readers installed throughout the district).
(2) No Substitutions.

2.8 MAGNETIC DOOR POSITION CONTACTS

A. Provide recessed magnetic door contacts where indicated on the drawings.

B. Door contacts shall be double pole, double throw type. The first set of leads will be connected to the access control system and the second set of leads will be connected to the intrusion detection system.

C. Connect door position contacts to the POE+ based door controller located above each card reader door.

D. Acceptable Products:

1. GE/Sentrol 1078.
2. Or Approved Equal.

2.9 REQUEST TO EXIT MOTION DETECTORS

A. Provide UL listed 24V request to exit motion detectors as shown on the drawings (color white).

B. Devices shall have 2 form “C” contacts adjustable up to 60 seconds.

C. Devices shall have programmable fail safe and fail secure modes.

D. Provide device trim plates as necessary.

E. Connect request to exit to the POE+ based door controller located above each card reader door.

F. Acceptable Products:

1. Bosch P/N DS160.
2. Or Approved Equal.

2.10 ELECTRIFIED DOOR LOCKS AND STRIKES

A. Electrified door hardware is specified in the Architectural door hardware schedule and installed by the door contractor.

B. Connect electrified door hardware to the POE+ based door controller located above each card reader door as required.

2.11 MANUAL DOOR RELEASE PUSH BUTTON (SINGLE POINT OF ENTRY DOOR)

A. Provide remote push button for manual release of electrified door hardware at the single point of entry door located in the entry vestibule. Push button shall be momentary.

B. Remote push button should be surface mounted below the admin reception desk. Coordinate mounting location with WCSD admin staff.

C. Push button shall have a green lens. Label button to correspond to the door being unlocked.

D. Acceptable products.

1. Securitron PB3-ER.
2. Or Approved Equal.

2.12 WIRELESS DOOR RELEASE PUSH BUTTONS (INTERIOR SINGLE POINT OF ENTRY DOOR)

A. Provide remote wireless push buttons for manual release of electrified door hardware at the single point of entry door located in the entry vestibule.

B. Remote push buttons should be battery operated pendant mount style and shall communicate with a wireless receiver mounted in the admin office.

C. Provide qty one (1) wireless receiver and qty two (2) wireless push buttons.

D. Provide conduit and wiring to the wireless receiver as shown on the drawings and as required for a complete and operable system.

E. Acceptable products.

1. Qty (1) Wireless receiver:

a. Inovonics P/N EN4204R.
b. Or Approved Equal.

2. Qty (2) Wireless 1-button pendant:

a. Inovonics P/N EN1223S.
b. Or Approved Equal.

2.13 VIDEO INTERCOM SYSTEM (MAIN EXTERIOR ENTRY DOOR)

A. Provide video intercom system for the main entry door consisting of a video/intercom door station and remote video/intercom admin console.

B. Door station shall be flush mounted, vandal resistant and constructed of stainless steel. Door station shall have call button, microphone, speaker and camera.

C. Admin console shall be desk mounted in the admin office. Provide power supply as required. Admin console shall have a button to release the electrified door hardware at the main entry door.

D. Provide conduit and wiring as shown on the drawings and as required for a complete and operable system.

E. Acceptable Products:

1. Vandal Resistant Door Station & flush back box:

a. Aiphone P/N JP-DVF.
b. Or Approved Equal.

2. Admin Console:

a. Aiphone P/N JP-4MED.
b. Or Approved Equal.

3. Admin Console desk stand:

a. Aiphone P/N MCS-S/A.
b. Or Approved Equal.

4. Power Supply:

a. Aiphone P/N PS2420UL.
b. Or Approved Equal.

2.14 ACCESS CONTROL CABLING

A. Install plenum rated Category 6 cable (jacket color gray) from the POE+ door controller above each card reader door to the telecom room serving the area. Category 6 cabling to be installed, terminated and tested in accordance with the Division 27 specifications.

B. Install 18/6 shielded twisted pair cable from smart card readers to the POE+ door controller located above each card reader door.

1. Acceptable Products:

a. Alpha Wire 5386C.
b. Or Equal by Belden, CommScope or WestPenn.

C. Install 18/2 stranded twisted pair from request to exit devices, door contacts and remote audible alarms to the POE+ door controller located above each card reader door.

1. Acceptable Products:

a. Belden 8461.
b. Or Equal by Alpha Wire, CommScope or Westpenn.

D. Install 18/2 stranded twisted cables to provide power to locks, request to exits and local alarms from the POE+ door controller located above each card reader door.

1. Acceptable Products:

a. Belden 8461.
b. Or Equal by Alpha Wire, CommScope or Westpenn.

2.15 CABLE SHEATH LABELS

A. Label cable sheaths at the point of termination with laser printed self-laminating wrap around vinyl labels.

B. Labels shall be white with black type. Label size shall be 1.0” wide by 1.5” high.

1. Acceptable Manufacturers:

a. Brady.
b. Belden.
c. Hellermann Tyton.
d. Or Approved Equal.

2.16 ACCESS CONTROL SYSTEM CARD STOCK

A. Provide qty (100) composite cards compatible with the smart card readers.

B. Contractor to enroll the cards in the access control system and shall train the owner on assigning the enrolled cards to specific users.

C. Acceptable Products:

1. Qty (100) HID iCLASS SE composite cards (P/N 3000PGGMN).
2. No Substitutions.

2.17 ACCESS CONTROL SYSTEM SOFTWARE

A. Washoe County School District has an existing door access control system including head-end server, software and licensing. The existing access control system software is Genetec Security Center v5.6. Washoe County School District has installed the Genetec Synergis Pro Package w/256 readers and 10 clients.

B. The contractor shall provide one (1) card reader license with five (5) year product maintenance agreement for each card reader on the project.

C. Acceptable Products;

1. Card Reader License with 5-year license – Provide Qty (1) license for each card reader on the project (Genetec P/N ADV-RDR-P-5Y).
2. No Substitutions.

PART 3 – EXECUTION

A. SECURITY CABLE ROUTING AND TERMINATION

1. Roughin conduit at doors with access control as shown on the drawings.
2. Prep door frames as required for access control devices.
3. Connect electrified door hardware provided by the door hardware installer to the access control system.
4. Route all cabling in conduit from the access control field devices at each door to the POE+ door controller located above each door. Terminate conduit at the lockable enclosure housing the POE+ door controller.
5. Route Category 6 cable from the POE+ based door controller located above each card reader door to the telecom room serving the area. Category 6 cabling

shall be installed, terminated and tested in accordance with the Division 27 specifications.

6. All conduit shall be routed concealed. Where this is not possible, notify the Architect and provide proposed routing of exposed conduit for review and approval. Paint exposed conduit to match existing surfaces.
7. Install access doors as necessary to provide reasonable access to POE+ door controllers, security cable and junction boxes located above inaccessible ceilings.
8. Ten feet of cable slack shall be stored in the security cable above the security panel enclosure.
9. Cables shall be installed in continuous lengths from origin to destination (no splices are permitted).
10. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer’s requirements and reference documents.
11. 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.
12. Cables shall be labeled with self-adhesive labels. At the security panel, each cable shall be clearly labeled on the cable jacket 1” from the termination location.
13. 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 gateways, intelligent controllers and POE+ door controllers indicating their function and IP address.

B. Label all security devices. Labels shall be placed in a concealed location and shall identify the ID of the device.

C. Label all equipment enclosures, power supplies and relays.

D. Label all batteries with the date that the batteries were installed.

E. Label all cables at the equipment enclosures. 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.

F. Install engraved name plate on the equipment enclosure in the main telecom room.

3.3 SYSTEM PROGRAMMING

A. Meet with the Owner to determine the required naming convention for sites, doors and card holder security groups. Meet with the Owner to determine the required system operation, functionality, user/group access rights and scheduling.

B. Provide list of equipment requiring an IP address to the WCSD IT Department prior to starting the work. The list shall include a description of the device, its location, MAC address and patch panel port in the telecom room that it is connected to. Assign IP addresses to devices as directed by WCSD.

C. Configure POE+ door controllers to communicate with the intelligent controllers at each site. Configure the intelligent controllers to communicate the gateway device at each site.

Configure the gateway appliance to communicate with the access control head-end server.

D. Integrate access control system at the site with existing head-end server. Work with the Owner to establish access permissions to logon to the software.

E. Program the security system in accordance with the Owner's requirements.

3.4 SYSTEM TESTING AND COMMISSIONING

A. The contractor shall perform 100% testing of the security doors and devices. All deficiencies shall be corrected and the devices re-tested. At a minimum, the following items shall be tested:

1. Card reader door:
   a. Valid card read.
   b. Invalid card read.
   c. Valid request-to-exit.
   d. Door forced open.
   e. Door held open.
   f. Door shunt.
2. Main Exterior Door Video Intercom System:
   a. Verify call button.
   b. Verify 2-way audio functionality.
   c. Verify camera operation.
   d. Verify master station door release functionality.
3. Single point of entry Interior Door:
   a. Verify manual push button door release.
   b. Verify wireless push button door release.
4. Magnetic Door Hold Open Release.
   a. Verify interface to paging system emergency code red push button.
   b. Verify release of magnetic door hold opens.

3.5 SYSTEM DEMONSTRATION AND TRAINING

A. Provide four (4) hours of training to the Owner's staff on the operation of the system. Training shall consist of two (2) 2-hour training sessions as scheduled by the Owner. Contractor shall provide a sign-in sheet indicating the date, time, location, name of trainer and names of staff personnel trained. A copy of the sign-in sheet shall be included with the O&M submittals at the completion of the project.

END OF SECTION 281000

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. Furnish cameras. Provide MAC address information to WCSD Project Manager. Assign IP addresses to cameras as provided by WCSD Project Manager. Provide temporary camera login credentials to WCSD Project Manager.

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 cameras licenses.

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. 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 manufacturer data sheets for the following equipment and software:

    a. Indoor fixed vandal resistant dome cameras.
    b. Outdoor fixed vandal resistant dome cameras.
    c. Outdoor fixed 4-sensor vandal resistant dome cameras.
    d. Camera supports including wall mount kits, corner mount kits, pole mount kits, gooseneck support arms, ceiling pendant kits, back boxes, etc.
    e. CAT 6 Cabling – Indoor Plenum Rated.
    f. CAT 6A Field Mount Plugs.
    g. 48-Port CAT 6A Patch Panels.
    h. 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, 2017 -- 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 2MP 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. Minimum 3MP, 1920x1080 Resolution.
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 P/N P3265-V.
   b. No substitutions.

2. Recess ceiling mount.
   a. Provide recess ceiling mount kit where shown on drawings (Axis P/N TP3201-E).
   b. No substitutions.

3. Pendant Mount:
   a. Provide pendant mount kit where shown on drawings including ceiling mount (Axis P/N T91B51), camera shroud (Axis P/N T94K01D) and

custom length 1.5 NPT extension column to clear ceiling obstructions (color white).
b. No substitutions.

2.2 FIXED INDOOR AND OUTDOOR VANDAL RESISTANT 5MP 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. Minimum 3MP, 2952x1944 Resolution.
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 P/N P3267-LV (Indoor) and P3267-LVE (Outdoor).
   b. No substitutions.

2. Recess ceiling mount.
   a. Provide recess ceiling mount kit where shown on drawings (Axis P/N TP3201-E).
   b. No substitutions.

3. Pendant Mount:
   a. Provide pendant mount kit where shown on drawings including ceiling mount (Axis P/N T91B51), camera shroud (Axis P/N T94K01D) and custom length 1.5 NPT extension column to clear ceiling obstructions (color white).
   b. No substitutions.

2.3 FIXED 20 MEGAPIXEL 4-IMAGE SENSOR 4-CAMERA 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. POE - IEEE 802.3af Compliant.
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 known equal.

2. Pendant Mount:
   a. Provide pendant mount kit where shown on drawings including ceiling mount (Axis P/N T91B51), camera shroud (Axis P/N T94N01D) and custom length 1.5 NPT extension column to clear ceiling obstructions (color white).
   b. No substitutions.

3. Exterior Corner Mount:
   a. Provide corner mount kit, gooseneck support arm, back box and camera shroud as required for exterior corner mounting (Axis T91A64, T91D61 and T94N01D).
   b. No substitutions.

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. No substitutions.

2.4 HORIZONTAL PLENUM RATED CATEGORY 6 CABLE.

A. See Section 271500 for requirements.

2.5 CATEGORY 6A FIELD MOUNT PLUGS

A. See Section 271500 for requirements.

2.6 CATEGORY 6 COPPER PATCH PANELS

A. See Section 271100 for requirements.

2.7 CATEGORY 6 COPPER PATCH CORDS

A. See Section 271100 for requirements.

2.8 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.

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 the IP camera to the telecom room identified on the Drawings.

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. Route conduit to minimize the amount of conduit exposed to view. Install rigid (RMC) conduit at all exterior locations.

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 the IP camera to the telecom room identified on the Drawings.

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 and adjust the cameras. Each camera view must be reviewed and signed off by WCSD IT.

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 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 phone drop at automatic dialer for remote central station monitoring. Provide supervised telephone line 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.
6. Section 28 10 00: Access Control.

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 access control, 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 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, fire, and access control system. 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. Telephone interface: The control panel in the IDS shall be equipped with a phone line monitor and shall interface with the phone lines via RJ-31X jacks for supervision of the telephone line connection.

1. The telephone line interface shall conform with FCC rules (Title 47 C.F.R. part 68).
2. When a telephone line is determined to be out of service by the IDS panel, the event will be annunciated locally on the ACC and transmitted to the central station over the alternate communications interface. The transmission delay of this message is programmable from ten to two-hundred forty seconds.

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. PSTN Dialer Card: Bosch B430.
   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 and voice cabling to the main control panel and dialer 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.

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.

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

SECTION 311000 – SITE CLEARING

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, Geotechnical Evaluation Silver Dollar Elementary School, dated June 10th 2024, prepared by Geotechnical & Environmental Services, Incorporated.

1.2 SUMMARY

A. The project requirements for Site Clearing shall be those specified in Section 300, Clearing and Grubbing and Section 301, Removal of Existing Improvements, 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 (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. The project requirements for Site Clearing shall be those specified in Section 300, Clearing and Grubbing and Section 301, Removal of Existing Improvements, of the Standard Specifications for Public Works Construction, Latest Edition.

END OF SECTION 311000

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.

A. Geotechnical Investigation Report, Geotechnical Evaluation Silver Dollar Elementary School, dated June 10th 2024, prepared by Geotechnical & Environmental Services, Incorporated.

B. SUMMARY

C. 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

D. of the Standard Specifications for Public Works Construction, Latest Edition, contract documents and the Geotechnical Investigation Report, Geotechnical Evaluation 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.

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 (Project No. R20236851E2), dated June 10, 2024, by Geotechnical and Environmental Services, Inc.
   a. The records of investigation of soil or subsurface conditions and logs of test borings are made available by the Architect but are NOT part of the Contract. 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: Structural fill and backfill shall be imported or approved on-site materials which are non-expansive, free of debris, organic materials, and other deleterious materials, and conforming to the following: Material shall be reasonably well graded with 100-percent passing the 4" sieve and less than 35-percent passing the #200 sieve. Resistance, R, value shall be 30 minimum. Dry weight soluble solids shall be less than 2-percent. Dry weight soluble sulfate shall be less than 0.2-percent. Soluble Soil Chloride Content shall be less than 500 ppm. Atterberg limits shall conform to the following table:

Maximum Liquid Limit	**Maximum Plasticity Index**
<35	<12

All material shall be approved by the Geotechnical Engineer prior to delivery and/or use.

B. Non-structural fill shall be approved by the Geotechnical Engineer prior to delivery and/or use.

C. 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.

D. Aggregate Base for interior concrete slabs, exterior concrete slabs, and sidewalk base: Comply with SSPWC Section 200.01 Type 2, Class B, Aggregate Base.

E. Retaining Wall Backfill: Retaining wall backfill shall be imported or approved on-site materials which are non-expansive, free of debris, organic materials, and other deleterious materials, and conforming to the following: Material shall be reasonably well graded with 100-percent passing the 4" sieve and less than 10-percent passing the #200 sieve. Resistance, R, value shall be 30 minimum. Dry weight soluble solids shall be less than 2-percent. Dry weight soluble sulfate shall be less than 0.2-percent. Soluble Soil Chloride Content shall be less than 500 ppm. Atterberg limits shall conform to the following table:

Maximum Liquid Limit	Maximum Plasticity Index
<35	<12

All material shall be approved by the Geotechnical Engineer prior to delivery and/or use.

F. 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.

G. 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.

H. 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.

I. 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 of clay soils, undocumented fill, surficial loose and/or disturbed soils fill from the building footprint to the required horizontal extents of engineered fill.
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: The soils exposed by excavations, which are to receive compacted fill or footings, shall be scarified to a depth of 8”, moisture conditioned to above optimum, and compacted to at least 90-percent relative compaction below improvements and 90-percent relative compaction outside of improvements. This moisture content shall be maintained by periodic surface wetting, or other methods, until the surface if covered by a least one lift of fill.

K. Fill and Backfill:

1. Overexcavate existing soils as required to allow placement of the minimum required thicknesses of structural fill. A minimum of 1’-6” thickness of structural fill is required below footings. A minimum of 1’-6” thickness of structural fill is required below building slabs-on-grade. Thickness of structural fill under slabs-on-grade does not include the aggregate base section. Structural fill shall extend a horizontal distance equal to at least 5’-0” beyond the edges of exterior foundations and a distance at least equal to the depth of structural fill beyond edges of interior foundations.
2. Fill as required to obtain required subgrades.
3. Backfill foundations and stemwalls.
4. 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.
5. Water or dry fill materials as necessary to obtain moisture content 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.

P. Retaining Wall Backfill:

1. All retaining walls, elevator pit walls etc. shall be backfilled using the specified materials for these locations. The excavation for these walls shall start two feet past the bottom edge of the wall footing and slope up no steeper than allowed by OSHA.

2. Retaining wall backfill shall be placed in 8-inch maximum vertical lifts and compacted to between 90 and 95% maximum dry density. Over-compaction adjacent to retaining walls shall be avoided and relatively light compaction equipment shall be used.

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.

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 Geotechnical Evaluation Silver Dollar Elementary School, dated June 10th 2024, prepared by Geotechnical & Environmental Services, Incorporated.

D.

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, Geotechnical Evaluation Silver Dollar Elementary School, dated June 10th 2024, prepared by Geotechnical & Environmental Services, Incorporated.

D. SUMMARY

E. 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 32 33 00 – SITE FURNISHINGS

PART 1 - GENERAL

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. Picnic Tables
2. Exterior Trash Receptacles
3. Owner-Furnished Equipment

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer’s standard submittal for review and approval.

B. Shop Drawings: Indicate materials, dimensions, tolerances, welding, fasteners, hardware, mounting, finish, and accessories. Include manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five years’ experience in producing site furnishings of the type specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials in their original sealed containers bearing the manufacturer’s name and identification of product.

B. Do not store products in a location with conditions outside the manufacturer’s absolute limits.

C. Materials delivered to the site shall be examined for concealed damage or defects in shipping.

D. Defects shall be noted and reported to the Owner's Representative in writing.

1.6 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 the manufacturer’s absolute limits.

1.7 WARRANTY

A. Warranty: Manufacturer's standard warranty.

1. Seller warranties to replace, or at seller's option, repair any product or part thereof which is found to be defective in material or workmanship for a period of one year from date buyer accepts products. All parts and labor required under warranty provisions shall be supplied free of charge.
2. Transportation costs of returning the products to and from repair facility or costs involved with contractor personnel traveling to buyer's facility for the purpose of repairing products on site shall be borne by seller during the 1-year warranty period.

PART 2 – PRODUCTS

2.1 PICNIC TABLES

A. Provide the following Basis of Design products or approved equal.

1. Manufacturer: Wabash Valley Manufacturing, Inc., DFW International Commerce Park, 2580 Esters Blvd, Suite 100, DFW Airport, TX 75261 USA. 1-800-253-8619.
   a. Picnic Table 1: Profile/Prestige Series, 6' portable picnic tables without backs, perforated pattern, in color as chosen by the owner from the manufacturer's full range of standard colors.
   b. Picnic Table 2: Profile/Prestige Series, 6' portable picnic ADA accessible table without backs, perforated pattern, in color as chosen by the owner from the manufacturer's full range of standard colors.
   c. Picnic Table 3: Profile/Prestige Series, 46-inch octagon portable picnic tables with 4 seats without backs, perforated pattern, in color as chosen by the owner from the manufacturer's full range of standard colors.
   d. Picnic Table 4: Profile/Prestige Series, 46-inch octagon portable, ADA accessible picnic table with 3 seats without backs, perforated pattern, in color as chosen by the owner from the manufacturer's full range of standard colors.

2. Heat fused poly-vinyl coating, finished on inner-metal structure, to an approximate 3/16" thickness. Framework assemblies finished with powder coating; electrostatically applied and oven cured according to powder manufacturer's specifications. With all required fasteners, stainless steel to resist corrosion.
3. Table Frame: Main supports constructed of 2-3/8" OD x 12 gage galvanized structural steel tubing. Mounting brackets, on legs, of ¼" plate.
4. Top & Seat: Expanded tops and seats using fabricated ¾" x #9 expanded steel mesh. Top and seat frame/mounting brackets of 10 gage steel. Top center support brace, running the length of the top, of ¼" x 1-1/2" steel flat bar. Ends of the rolled sides, of the top and seat, using a ½" diameter steel rod to add support. Seat using a ¼" x 1-1/2" steel flat bar for added support, on the underside of the seat's crease, in the contour shape.
5. General: Ground space requirements for 6' picnic tables are 62-3/8" x 72-1/8". The benches are 18-1/4" to the highest part in the seat and 30-1/8" to the top of the table.
6. Color to be selected by Architect from Manufacturer's standard color line.

2.2 TRASH RECEPTACLES

A. Receptacles: Classic Collection as manufactured by Wabash Valley Site Furnishings.

1. Manufacturer: Wabash Valley Manufacturing, Inc., DFW International Commerce Park, 2580 Esters Blvd, Suite 100, DFW Airport, TX 75261 USA. 1-800-253-8619.
2. Description: Steel, with flat top lid secured to container by steel cable. Adjustable feet to stabilize container on uneven surfaces.
3. Mounting: As indicated on Drawings
4. Pattern: Diamond
5. Finishes: Tiger Drylac, triglycidyl isocyanurate (TGIC) polyester powder coatings, 6-8 mils thick.
6. Color to be selected by Architect from Manufacturer's standard color line.
7. Capacity: 55 gallons
8. Lid Style: Flat top.
9 Provide 55 – gallon drum for each receptacle. Drum to be painted black.

2.3 ACCESSORIES

A. Picnic Table Surface Mount Clips: Manufacturer's standard clip for 2-3/8" OD frame legs, with ½" diameter hole for anchorage, and powder coated finish of color to match table. Install clips using 3/8" diameter x 3" Stainless Steel Titen HD anchors as manufactured by Simpson Strong-Tie or approved equal.

2.4 OWNER-FURNISHED, CONTRACTOR INSTALLED EQUIPMENT

A. Exterior Benches
   1. Six (6) outdoor benches shall be bolted to the concrete flatwork. Location to be coordinated with the Owner's personnel.

2.5 FINISHES

1. 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 upon which site furnishings will be installed. Verify that surfaces are clean, flat and level within manufacturer's recommended installation tolerances.

B. If preparation is the responsibility of another installer, notify Architect of deviations from manufacturer's recommended installation tolerances and conditions.

C. Do not proceed with installation until substrates have been properly prepared and deviations are corrected.

D. Commencement of installation constitutes acceptance of conditions.

3.2 ASSEMBLY

A. Assemble per manufacturer's instructions, using all supplied fasteners.

3.2 INSTALLATION

A. Coordinate approved layouts and locations with Owner prior to final installation.

B. Install site furnishings in accordance with manufacturer's installation instructions.

B. Install site furnishings level, plumb, square, accurately aligned, correctly located per drawings, and without warp.

C. Mounting: Hardware and fasteners in accordance with manufacturer's instructions

1. For Site Furnishings with Embedded Mounting: Direct embedment of site furnishings to be minimum of 10-1/2 inches (267 mm) in concrete in accordance with manufacturer's instructions.
2 For Surface Flange Mounting Site Furnishings: Anchor site furnishings securely in place with 1/2-inch x 4-inch (13 mm x 102 mm) anchor bolts through flange holes.
3. For Free Standing Site Furnishings: Site furnishings to stand freely. Place in accordance with Drawings.

D. Fasten tables to concrete surface below using manufacturer’s standard picnic table surface mount clips. (4) clips per table; one clip per table leg. Fasten clips to concrete using the specified concrete screw anchors.

END OF SECTION 32 33 00

SECTION 32 84 00- PLANTING IRRIGATION

PART 1—GENERAL

1.01 WORK INCLUDED - Work of this Section generally includes provisions for the installation of an underground and surface installation landscape irrigation system including the following:

A. Static pressure verification and coordination of irrigation system installation with landscape material installation. Verification of a minimum flow of 30gpm @ 30 psi at the filter location.

B. Trenching, stockpiling excavation materials, refilling and compacting trenches.

C. Complete irrigation system from existing points of connection, including but not limited to, filter, flow sensor, piping, valves, fittings, emitter heads, controller wiring, and final adjustments to insure proper flow.

D. Water connection to existing systems.

E. Replacement of unsatisfactory materials.

F. Clean-up, Owner Reviews, and Project Acceptance.

G. Testing of Irrigation System(s).

1.02 RELATED SECTIONS

A. Examine all sections related to project work.

1.03 REFERENCES

A. Perform Work in accordance with requirements of Conditions of the Contract and Division 01 - General requirements as well as provisions of all applicable laws, codes, ordinances, rules, and regulations.

B. Conform to requirements of reference information listed below except where more stringent requirements are shown or specified in Contract Documents.

1. American Society for Testing and Materials (ASTM) - Specifications and Test Methods specifically referenced in this Section.
2. Underwriters Laboratories (UL) - UL Wires and Cables.

1.04 QUALITY ASSURANCE

A. Installer Qualifications - Installer shall have had considerable experience and demonstrate ability in the installation of irrigation system(s) of specific type(s) in a neat orderly, and responsible manner in accordance with recognized standards of workmanship. To demonstrate ability and experience necessary for this Project, submit if requested by Owner and/or Owner Representative, prior to contract award the following:

1. List of 5 projects completed in the last 2 years of similar complexity to this Project. Description of projects shall include:
   a. Name of project.
   b. Location.
   c. Owner.
   d. Brief description of work and project budget.

e. Reference contact name & telephone number

B. Special Requirements:

1. Work involving substantial plumbing for installation of copper and/or ductile iron piping, backflow preventer(s), and related work shall be executed by licensed and bonded plumber(s). Secure a permit at least 48 hours prior to start of installation.
2. Tolerances - Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, compaction, and repair of finish grade treatment.
3. Coordination with Other Contractors - Protect, maintain, and coordinate Work with Work under other Section.
4. Damage To Other Improvements - Contractor shall replace or repair damage to grading, soil preparation, seeding, sodding, or planting done under other Sections during Work associated with installation of irrigation system at no additional cost to Owner.

C. Pre-Construction Conference - Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials, and systems used to perform the Work. Conference shall be scheduled not less than 10 days prior to commencement of Work. All parties required to be in attendance shall be notified no later than 7 days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to Architect, Owner, Contractor's Superintendent, and Installer.

1. Minutes of conference shall be recorded and distributed by Contractor to all parties in attendance within five days of conference.

1.05 SUBMITTALS - Prepare and make submittals in accordance with conditions of the Contract.

A. Materials List - Submit one digital copy of a complete materials list indicating manufacturer, model number, and description of all materials and equipment to be used.

B. Record Drawings (As-Builts):

1. At onset of irrigation installation secure Autocadd files of original irrigation design from Owner. At the end of every day, revise as-built prints for work accomplished that day in red ink. Irrigation system record/as-built field prints shall be brought up-to-date at the close of the working day every Friday by a qualified draftsperson. A print of record plan(s) shall be available at Project Site. Indicate zoning changes on weekly record drawings. Indicate non-pressure piping changes on record drawings. Upon completion of Project, submit for review, prior to final acceptance, final set of irrigation systems record drawings, and a compact disk containing Autocadd files of record drawings. Dimensions, from two permanent points of reference of buried components (building corners, sidewalk, road intersections or permanent structures), location of following items:
   a. Connection to existing water lines.
   b. Routing of irrigation pressure lines (dimension maximum 50 feet along routing).
   c. Control valves.
   d. Quick coupling valves.
   e. Manual drains
   f. Stop and waste valves.
   g. Drip line blow-out stubs.
   h. Control wire routing if not with pressure mainline.

i. Gate valves.
j. Control wire splices
k. Pressure regulating valves
l. PVC lateral header to flexible tubing.
m. Shrub emitter flushing endcaps.

2. Contractor shall provide two bound copies of completed, approved record drawings and CD containing Autocadd file(s) of record drawings(s).

C. Operation Instructions - Submit 3 written operating instructions including winterization procedures and start-up, with cut sheets of products, and coordinate controller/watering operation instruction with Owner maintenance personnel.

1. Controller Charts
   a. Do not prepare charts until Owner has reviewed record (as-built) drawings.
   b. Provide one controller chart for each area installed.
      1) Chart may be reproduction of record drawing, scaled to fit into controller valve box. If reduction prints are required, keep reduction to maximum size possible to retain full legibility.
      2) Chart shall be blackline print of actual "as-built" system, showing area covered by that controller.
   c. Identify area of coverage of each remote control valve, using a distinctly different pastel color drawing over entire area of coverage.
   d. Following review of charts by Owner, they shall be hermetically sealed between two layers of 20-mm thick plastic sheet
   e. Charts shall be completed and reviewed prior to final review of irrigation system.

D. Manufacturer Warranties – Contractor shall provide Owner with two copies of written manufacturer warranties for one year as published by each equipment and material manufacturer for products installed on Project. Manufacturer warranty information shall be provided for controller(s), all valves, piping, heads, backflow preventer(s), enclosures and valve boxes.

E. Operating instructions and manufacturer warranty information shall be contained within three ring binder (one binder per set).

1.06 DELIVERY, STORAGE, AND HANDLING - Deliver, unload, store, and handle materials, packaging, bundling, products in dry, weatherproof, condition in manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism. Deliver in original unopened packaging containers prominently displaying manufacturer's name, volume, quantity, contents, instructions, and conformance to local, state, and federal law. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, snow, ice, temperature extremes, fire, or jobsite damage.

A. Handling of PVC Pipe - Exercise care in handling, loading and storing, of PVC pipe. All PVC pipe shall be transported in a vehicle which allows length of pipe to lie flat so as not to subject it to undue bending or concentrated external loads. All sections of pipe that have been dented or damaged shall be discarded, and if installed, shall be replaced with new piping.

1.07 JOBSITE CONDITIONS:

A. Protection of Property:

1. Preserve and protect all trees, plants, monuments, structures, and paved areas not to be removed from damage due to Work of this Section. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to satisfaction of Owner, and all injury to living plants shall be repaired by Owner. All costs of such repairs shall be charged to and paid by Contractor.
2. Protect buildings, walks, walls, and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete, or other building material surfaces shall be repaired or replaced at no cost to Owner. Restore disturbed areas to original condition.

B. Protection and Repair of Underground Lines:

1. Request proper utility company to stake exact location (including depth) of all underground electric, gas, or telephone lines. Take whatever precautions are necessary to protect these underground lines from damage. If damage does occur, Utility Owner shall repair all damage. Contractor shall pay all costs of such repairs unless other arrangements have been made.
2. Request Owner, in writing, to locate all private utilities (i.e., electrical service to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities that were not staked are encountered and damaged by Installer, Owner shall repair them at no cost to Installer. If Contractor damages staked or located utilities, they shall be repaired by Utility Owner at Contractor's expense unless other arrangements have been made.

C. Protection of Paving and Curbs - Where trenches and lines are near existing roadways, paths, curbing, etc., take whatever precautions are necessary to protect improvements and contractor shall replace or restore to original condition if any damage occurs.

1.08 WARRANTY/GUARANTY: - Contractor shall warrant materials, equipment and workmanship against defects for a period of 12 months from date of Substantial Completion.

A. Settling of backfilled trenches that may occur during guaranty period shall be repaired by Contractor at no expense to Owner, including complete restoration of damaged property.

B. Expenses due to vandalism prior to substantial completion shall be borne by Contractor.

C. Contractor will maintain planting areas during warranty period, so as not to hamper proper operation of irrigation system.

1.09 MAINTENANCE:

A. Furnish the following maintenance items to Owner prior to final Acceptance:

1. Two Sets of special tools required for removing, disassembling, and adjusting each type of irrigation head and valve supplied on this Project.
3. One 4’ foot valve keys for operation of gate valves.
4. One quick coupler keys and one matching hose swivel for each type of quick coupling valve installed.
5. Two aluminum drain valve keys of sufficient length for operation of drain valves.
6. Controller cage & cabinet keys.
7. (1) Rainbird LIMR- KIT remote control hand held kit

B. Winterization - include cost in bid for winterizing complete system at conclusion of irrigation season (in which system received final acceptance) within 3 days notification by the Owner. System shall be voided of water using compressed air or similar method reviewed by Owner. Reopen, operate, and adjust and/or repair system accordingly during April of following season within 3 days of notification by Owner.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General Piping:

1. Pressure Supply Line (from point of connection through backflow prevention unit) - Type "k" Rigid Copper or Brass.
2. Pressure Supply Lines (downstream of backflow prevention units) – Schedule 40 PVC Solvent Weld purple pipe
3. Non-pressure Lines – Schedule 40 PVC Solvent Weld – 1” minimum diameter.
4. PVC Sleeving – Schedule 40 PVC Solvent Weld. Purple pipe.
5. Drip Tubing - Pepco 3/4" flexible poly tubing or equal.
6. Emitter Distribution Tubing – ¼” As recommended by emitter manufacturer.

B. Copper Pipe and Fittings:

1. Copper Pipe - Type K.
2. Fittings - Wrought copper, solder joint type.
3. Joints - Soldered with solder, 45% silver, 15% copper, 16% zinc, and 24% cadmium and solidus at 1125~F and liquids at 1145~F.

C. Brass Pipe and Fittings:

1. Brass Pipe - 85% red brass, ANSI Schedule 40 screwed pipe.
   a. Teflon Tape – All brass male threaded fittings and nipples shall receive wrapping of Teflon tape applied to threaded surfaces per pipe manufacturer’s recommendations.
2. Fittings - Medium brass, screwed 125-pound class.

D. Plastic Pipe and Fittings:

1. Identification Markings:
   a. Identify all pipe with following indelible markings:
      1) Manufacturer's name.
      2) Nominal pipe size.
      3) Schedule of class.
      4) Pressure rating.
      5) NSF (National Sanitation Foundation) seal of approval.
      6) Date of extrusion.

2. Solvent Weld Pipe - Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12454-B, Type 1, Grade 1.
   a. Fittings - Standard Wright, Schedule 40, injection molded PVC; complying with ASTM D1784 and D2466, cell classification 12454-B.
      1) Threads - Injection molded type (where required).
      2) Tees and ells - Side gated.

b. Threaded Nipples - ASTM D2464, Schedule 80 with molded threads.
c. Thread Sealant – All PVC male threaded fittings and nipples, excluding marlex fittings, shall receive non-hardening thread sealant/paste containing no petroleum distillates applied to threaded surfaces per pipe manufacturer's recommendations (Spears 75 Blue or equal).
d. Joint Cement and Primer - Type as recommended by manufacturer of pipe and fittings.

E. Drip Irrigation Systems:

1. Drip Tubing - Manufactured of flexible vinyl chloride compound conforming to ASTM D1248, Type 1, Class C, Category 4, P14 and ASTM D3350 for PE 122111C.
2. Fittings - Type and diameter recommended by tubing manufacturer.
3. Drip Valve Assembly – **Rain Bird XCZ-100-PRB-COM**
   a. Wye Strainer - Plastic construction with 200 mesh nylon screen and 1/2 inch blow-out assembly.
   b. Control Valve - 2 way, solenoid pilot operated type made of synthetic, non-corrosive material; diaphragm activated and slow closing. Include freely pivoted seat seal; retained (mounted) without attachment to diaphragm.
   c. Pressure Reducing Valve - Plastic construction, non-adjustable pressure setting of 40 PSI, as detailed.
4. Emitters – Pressure Compensating with insert barb (**Rain Bird XB-10)**

F. Gate Valves:

1. Gate Valves for 1 inch through 2-1/2 Inch Pipe - Brass construction; solid wedge, IPS threads, and non-rising stem with cross-type operating handle **(NIBCO T-113).**

G. Quick Coupling Valves - Brass two-piece body designed for working pressure of 150 PSI; operable with quick coupler. Equip quick coupler with locking rubber cover. **Rain Bird 44 LNP**

H. Valve Boxes: (all purple lid)
1. Gate Valves, Quick Coupling Valves, Drain Valves, Drip Line Blow-out Stubs, and Wire Splice or Stub Box - Carson #910-10 box with lid. 6" round valve boxes are not acceptable.
2. 1 inch through 2 inch Control Valves, Pressure Regulating Valves - Carson Brooks #1220 box with lid.
3. Drip Valve Assemblies, 1 inch through 2 inch Master Valves - Carson #1220 box with lid.
4. ¾" Stop and Waste Valve – Cast iron stop box with adjustable barrel and cover with bolt – Tyler or equal.

I. Electrical Control Wiring:

1. Low Voltage:
   a. Electrical Control Wire - AWG UFUL approved No. 14, direct burial, single conductor, solid copper wire
   b. Electrical Common Wire - AWG UFUL approved No. 14, direct burial, single conductor, solid copper wire
   c. Wire Colors:
      1) Control Wires - Red.
      2) Common Wires - White.

3) Master Valve Wires - Blue.
4) Spare Control Wires - Black.
5) Spare Common Wires - Yellow.

d. If multiple controllers are utilized, and wire paths of different controllers cross each other, both common and control wires from each controller shall be different colors approved by Owner.

e. Control Wire connections and splices shall be made with 3M DBY direct bury splice.

2. High Voltage - Type required by local codes and ordinances, of proper size to accommodate needs of equipment serviced.

J. Automatic Controller - Type shall be sized to permit each electric valve to have single, dedicated station on controller. Model(s) **Rainbird ESP LXME**

K. Master Control Valve - Size and type shown on Drawings having manual flow adjustment and manual operational nut with internal bleed. **Rainbird PESB**

M. Backflow Preventer – Reduced pressure-principle model, exterior installation ; Brass; with 150 psi working pressure. **Existing per civil dwg.**

N. Flow Sensor- Size and type shown on Drawings. **Rainbird FS150P**

O. Filter: 2” automatic self cleaning with 130 micron screen. Amiad 2” TAF 750E.

P. Filter cage per plan and “Bully Bag” cover, color green.

PART 3 - EXECUTION

3.01 SITE CONDITIONS, LANDSCAPE PLAN REVIEW AND COORDINATION

A. Contractor will be held responsible for coordination between landscape and irrigation system installation. Landscape material locations shown on the Landscape Plan shall take precedence over the irrigation system equipment locations. If irrigation equipment is installed in conflict with the landscape material locations shown on the Landscape Plan, the Contractor will be required to relocate the irrigation equipment, as necessary, at Contractor’s expense.

B. Contractor is responsible to notify Owner of any field conditions that vary from the conditions shown on the Irrigation Construction Documents. If Contractor fails to notify Owner of these conditions, Contractor will be held responsible for all costs associated with system adjustments required due to the change in field conditions.

3.02 STATIC PRESSURE & FLOW RATE VERIFICATION **-** Contractor shall field verify the static pressure after installation of the pressure regulator and verify a min. of 30 gpm flow rate at the point of connection, prior to commencing work or ordering irrigation materials, and submit findings, in writing, to Owner. If Contractor fails to verify static water pressure and flow rate prior to commencing work or ordering irrigation materials, Contractor shall assume responsibility for all costs required to make system operational and the costs required to replace any damaged landscape material. Damage shall include all required material costs, design costs and plant

replacement costs.

3.03 INSPECTION: - Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected.

A. Grading operations, with the exception of final grading, shall be completed and approved by Owner before staking or installation of any irrigation system begins.

B. Underground Utilities shall be installed prior to installation of irrigation system. If irrigation installation takes place prior to utility installation, Contractor shall notify Owner of this condition in writing prior to commencement of irrigation installation.

3.04 PREPARATION:

A. Staking shall Occur as Follows:

1. Mark, with powdered lime, routing of pressure supply line and valve locations for each zone. Contact Owner 48 hours in advance and request review of staking. Owner will advise installer as to the amount of staking to be prepared. Owner will review staking and direct changes if required.
2. If Project has significant topography, freeform planting beds, or other amenities, which could require alteration of irrigation equipment layout as deemed necessary by Owner, do not install irrigation equipment in these areas until Owner has reviewed equipment staking.

B. Install sleeving under asphalt paving and concrete walks and provide stub to raised planter areas, prior to concreting and paving operations or footing and CMU block, to accommodate piping and wiring. Compact backfill around sleeves to 95% Modified Proctor Density within 2% of optimum moisture content in accordance with STM D1557.

C. Trenching - Trench excavation shall follow, as much as possible, layout shown on Drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed. Do not trench within the drip line of existing trees if present. Trenching in areas where existing trees are present shall be routed to avoid damage to existing roots to the extent possible. Notify the county and landscape architect of roots larger than 2” diameter required to be cut. Roots shall be cut vertical with a saw if required, do not rip or tear root.

1. Clearances:
   a. Piping 3 Inches and Larger - Make trenches of sufficient width (12 inches minimum) to properly assemble and position pipe in trench. Minimum clearance of piping 3 inches or larger shall be 4 inches horizontally on both sides of the trench.
   b. Piping Smaller than 3 Inches - Trenches shall have a minimum width of 6 inches.
   c. Line Clearance - Provide not less than 6 inches of horizontal clearance between each line and not less than 12 inches of clearance between lines of other trades. Vertical “stacking” of multiple runs of irrigation piping within common trench is not acceptable.

2. Pipe and Wire Depth:

   a. Service Line (From water tap to connection to backflow prevention device) - Depth as required by water service provider)
   b. Pressure Supply Piping (Mainline) – 24” inches from top of pipe.
   c. PVC Sleeving – Road/Street/Drive – 24” inches minimum/28 inches

maximum depth of cover as measured from top of sleeve to bottom of road surfacing material. Pedestrian walks – Depth shall equal depth of piping and/or wiring to be contained within sleeving as indicated on plan as measured from top of sleeving to top of path/walk.

d. Control Wiring - Side of pressure main or at 24” inch depth if installed in a separate trench containing no mainline piping.
e. Drip Tubing - Bed Areas – 4” depth.
f. Emitter Tubing (Micro-tubing) – 4” depth except at plant basin.

3. Boring will be permitted only where pipe must pass under obstruction(s) which cannot be removed. In backfilling bore, final density of backfill shall match that of surrounding soil. It is acceptable to use sleeves of suitable diameter installed first by jacking or boring, and pipe laid through sleeves. Observe same precautions as though pipe were installed in open trench.
4. Vibratory Plow – Not an acceptable of installation for irrigation piping and/or wiring.

3.05 INSTALLATION **-** Locate equipment as near as possible to locations designated. Owner shall review and approve deviations prior to installation.

A. Service Line Piping (copper piping from water meter to connection to backflow prevention device) - When pipe installation is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform Work in accordance with good practices prevailing in piping trades.

1. Copper piping – Installation shall match specifications for copper service line as required by water department/water provider associated with project.

B. PVC Piping - Snake pipe in trench as much as possible to allow for expansion and contraction. Do not install pipe when air temperature is below 40 degree Fahrenheit. Install manual drain valves at low points and dead ends of pressure supply piping to insure complete drainage of system. Installation of multiple runs of piping in common (joint) trench is not permissible. When pipe installation is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform Work in accordance with good practices prevailing in piping trades.

1. Solvent Weld PVC Pipe - Lay pipe and make all plastic to plastic joints in accordance with manufacturer's recommendations.
2. All fittings have a min. 2” clearance from other pipe or fittings.

C. Drip Tubing:

1. Make all fitting connections as per manufacturer’s recommendations.
2. Use only manufacturer provided or recommended hole punch when making penetrations in drip tubing for micro-tubing barbed fittings. Use of any other hole punch shall be cause for immediate removal and replacement of all installed drip tubing.
3. Install drip line blow-out stubs at all dead ends of drip tubing (place in round box)
4. Flushing - After tubing, barbed fittings and micro-tubing is place and connected, but prior to installation of emitters, thoroughly flush drip tubing under full head of water pressure through blow-out/flush-out stubs installed at ends of lines. Maintain flushing for 5 minutes through all blow-outs.
5. Stake ¼” tubing with wire staples after final preparation of subgrade prior to mulch installation to prevent movement. The ¾” tubing shall be installed under subgrade, buried a min of 4” depth.

D. Control Wiring:

1. Low Voltage Wiring:
   a. Bury control wiring between controller and electric valves in pressure supply line trenches, strung as close as possible to main pipe lines with such wires to be consistently located below and to one side of pipe, or in separate trenches.
   b. Bundle and tape all 24 volt irrigation wires with electrical tape at 15 foot intervals and lay with pressure supply line pipe to one side of the trench. Irrigation wiring installed above/over pressure supply line is not acceptable.
   c. Provide an expansion loop at every pressure pipe angle fitting and every 100 feet. Form expansion loop by coiling wire bundle and lay formed coil in trench prior to backfilling.
   d. Provide continuous loop of all spare “maintenance” wires (see below) within every valve box containing electric control valve or drip valve assembly (See item (h) below). Construct loop within valve box by wrapping wire at least 8 times around a 3/4 inch pipe and withdrawing pipe.
   e. Make all splices and electric control valve connections using 3M Company DBY waterproof wire splice connector kits.
   f. Install all control wire splices not occurring at control valve in a separate splice valve box.
   g. Install one control wire for each control valve.
   h. Maintenance Spare Wires - Install one spare #14 AWG UFUL control wires to each valve location and one common wire from irrigation controller to the end of each and every leg of mainline and or valve manifolds. Label spare wires at controller and wire stub box.
2. High Voltage Wiring for Automatic Controller and/or Pumps:
   a. Provide electric power and connection(s) to automatic controllers and irrigation pumping system(s).
   b. All electric work shall conform to local codes, ordinances, and authorities having jurisdiction. All high voltage electrical work shall be performed by licensed electrician.
   c. Electrical one-line diagrams required for permitting are to be prepared and paid by Contractor. Drawings shall be submitted to building department by Contractor.
3. Trailer wire: Install (1) green wire from the back of the controller in all mainline & pvc lateral trenches.

E. Automatic Controller:

1. Install controller in accordance with manufacturer's instructions as detailed and where shown on Drawings.
2. Connect electric control valve wiring to controller in numerical sequence as shown on Drawings.
3. Exposed, bare ends of copper wiring connected to terminal strips shall not exceed 3/8” except where longer exposed length is required to complete connection.
4. Use of 18 ga. multi-strand cable within controller is not permitted unless noted on details or approved by Owner prior to installation.
5. Furnish 9 volt back-up battery.
6. Install IQ NCC network card. Verify school district form of IQQ NCC communication.

F. Drip Valve Assemblies - Install cross-handle four inches below finished grade where

shown on Drawings as detailed. When grouped together, allow at least 12 inches between valve box sides. When installed adjacent to curbing and walks, allow 24 inches between valve box and walk/curb. Install each remote control valve in a same valve box per controller with box centered over valve assemblies. Install valve box flush with grade.

G. Quick Coupling Valves - Install quick couplers on swing-joint assemblies; plumb to grade. Angled nipple relative to pressure supply line shall be no more than 45 degrees and no less than 10 degrees.

H. Drip Emitters/bubblers - Stake all emitters/bubblers 1”-2” subsurface as detailed and staked with wire staples.

I. Drain Valves - Install one ¾” manual drain valve on pressure supply line directly downstream of backflow prevention device as detailed, In addition, install manual drain valve(s) at low point in pressure mainline(s) as dictated by field conditions. Provide a three cubic foot drainage sump for drain valve as detailed. Install (1) every 40 L.F. of mainline & (1) at every valve manifold.

J. Valve Boxes:

1. Install one curb stop valve box for each valve as detailed. Valve box extensions are not acceptable except for master valves, pressure regulating valves, or other irrigation equipment installed at depth of pressure mainline. Install gravel sump after compaction of all trenches. Place final portion of gravel inside valve box after valve box is backfilled and compacted.

K. Gate Valves - Install where shown on Drawings as detailed.

L. Backflow Prevention Device – Field verify it is in good operating condition.

M. Backfilling - Do not begin backfilling operations until required system tests have been completed. Backfill shall not be done in freezing weather except with review by Owner. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finish graded prior to walk-through of system by Owner.

1. Materials - Excavated material is generally considered satisfactory for backfill purposes. Backfill material shall be free of rubbish, vegetable matter, frozen materials, and stones larger than 1 inch in maximum dimension. Do not mix subsoil with topsoil. Material not suitable for backfill shall be hauled away. Contractor shall be responsible for providing suitable backfill if excavated material is unacceptable or not sufficient to meet backfill, compaction, and final grade requirements.
2. Do not leave trenches open for a period of more than 48 hours. Open excavations shall be protected in accordance with OSHA regulations.
3. Compact backfill to 90% maximum density, determined in accordance with ASTM D155-7 utilizing the following methods:
   a. Mechanical tamping.
   b. Puddling or ponding. Puddling or ponding and/or jetting is prohibited within 20’-0" of building or foundation walls.

N. Filter: Install self flushing filter after verification of flow rate per mfg. spec. Filter shall be installed with a 2” flush valve with threaded union joint for maintenance. The 2” pipe joint for maintenance. The 2” pipe lateral from flush valve shall not extend more than 15’ from flush vale t sump. Coordinate 110 power source for filter operation with general contractor. Provide a minimum 3’ x 3’ x 3’ sump with ¾” drain rock. Install protective cover over filter for protection.

O. Piping Under Paving:

1. Provide for a minimum cover of 24 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete or concrete paving.
2. Piping located under areas where asphalt or concrete paving will be installed shall be bedded with sand (a layer 6" below pipe and 6" above pipe).
3. Compact backfill material in 6" lifts at 90% maximum density determined in accordance with ASTM D155-7 using manual or mechanical tamping devices.
4. Piping under existing walks or concrete pavement shall be done by jacking, boring, or hydraulic driving, but where cutting or breaking of walks and/or concrete is necessary, it shall be done and replaced at not cost to Owner. Obtain permission to cut or break walks and/or concrete from Owner.

P. Water Supply and Point of Connection - Water supply shall be extended as shown from existing reclaimed water meter supply line.

3.06 FIELD QUALITY CONTROL:

A. Flushing - After piping and valves are in place and connected, but prior to installation of emitter/bubbler heads, quick coupler assemblies, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthermost valves. Cap risers after flushing. If nay line breaks occur during construction, open end plugs and flush lines prior to running emitters/bubblers.

B. Testing - Conduct tests in presence of Owner. Arrange for presence of Owner 48 hours in advance of testing. Supply force pump and all other test equipment.

1. After backfilling, and installation of all control valves, fill pressure supply line with water, and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours. Pressure testing of pressure supply line utilizing compressed air is not acceptable.
2. Leakage, Pressure Loss - Test is acceptable if no loss of pressure is evident during the test period.
3. Leaks - Detect and repair leaks.
4. Retest system until test pressure can be maintained for duration of test.
5. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours.

C. Walk-Through for Substantial Completion:

1. Arrange for Owner's presence 48 hours in advance of walk-through.
2. Entire system shall be completely installed and fully operational prior to scheduling of walk-through. This shall include all control valves capable of being operated via irrigation controller.
3. Electrically operate each zone in its entirety for Owner at time of walk-through and additionally, open all valve boxes if directed.
4. Owner shall generate a list of items to be corrected prior to Final Completion.
5. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents.
6. During walk-through prior to installation of mulches, expose all drip emitters under operation for observation by Owner to demonstrate that they are performing and installed as designed, prior to placing of all mulch material. Schedule separate walk-through if necessary.
7. Supply Owner with one set of full-size prints (not original drawings) of completed

contractor-prepared irrigation as-built field drawings prior to start of substantial completion walk-through.

D. Walk-Through for Final Completion: After 1 year maintenance period.

1. Arrange for Owner's presence 48 hours in advance of walk-through.
2. Show evidence to Owner that Owner has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
3. Electrically operate each zone, in its entirety for Owner at time of walk-through to insure correction of all incomplete items.
4. Items deemed not acceptable by Owner shall be reworked to complete satisfaction of Owner.
5. If after request to Owner for walk-through for Final Completion of irrigation system, Owner finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by Owner to conduct and document further walk-throughs as deemed necessary to insure compliance with Contract Documents.

3.07 ADJUSTING - Upon completion of installation, "fine-tune" entire system by regulating valves, adjusting emitters/bubblers, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage and per soil infiltration capacity.

A. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by Owner, contractor shall make such adjustments prior to Final Acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in nozzle sizes, degrees of arc, and control valve throttling.

B. Areas which do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the Owner.

3.08 CLEANING - Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site at no additional cost to Owner, all trash, debris and excess soil generated by installation of irrigation system

3.09 Instruct owner on operation of irrigation components.

END OF SECTION

SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plants.
2. Planting soils.

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

F. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

G. Planting Soil: existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

H. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

I. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

J. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

K. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

L. Plants: Container grown stock only, no bare root.

1.3 SUBMITTALS (1 digital copy)

A. Product Data: For each type of product indicated, including soils and plant list.

B. Samples of mineral mulch, topsoil, playground bark, rock cobble.

C. Product certificates.

D. Soil Analysis Reports

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year from date of substantial completion.

1.4 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

1. Pesticide Applicator: State licensed, commercial.

B. Soil Analysis: For each soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory after import topsoil installation and site grading has been completed. Onsite blended topsoil in planter areas shall be submitted to Full Circle Soil & Compost following their soil analysis process. 775-267-5305.

1. Report suitability of tested soil for plant growth of turf and container material.

a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

D. Preinstallation Conference: Conduct conference at site dictated by owner.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver container plants to site, keep root system moist until planting.

B. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

C. Handle planting stock by container.

D. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.

E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1.6 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.

2. Warranty Periods from Date of Planting Substantial Completion:

a. Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
c. Trees: 24 months.

1.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period for Trees and Shrubs: 12 months from date of planting substantial completion.
2. Maintenance Period for Ground Cover and Other Plants: Twelve months from date of planting substantial completion.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown container plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 10-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.5 PLANTING SOILS

A. Planting Soil: Existing, native surface soil formed under natural conditions with the duff layer retained during excavation process. Landscape contractor shall test onsite soil and provide an agricultural soil lab suitability report and submit for approval prior beginning landscape and irrigation work. Soil report amendments shall be incorporated into planter area native soil prior to irrigation work. Clean soil of roots, plants, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. In addition to amending planter soil prior to planting amend plant pit backfill material per soil analysis recommendations.

PART 3 - EXECUTION

3.1 PLANTING AREA ESTABLISHMENT

A. Loosen blended planter area soils to a minimum depth of 12 inches (300 mm) if soil has become compacted. Remove sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Planter area: Spread amendment on top of planter soil to a depth per soil analysis. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade planting areas and or to a smooth, uniform surface plane with loose, uniform texture. Planters shall drain per civil grading plan.

3.2 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate a minimum of three times as wide as ball or container diameter.
2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

B. Mounding: Mounding per landscape plan is to be installed by the landscape contractor. Mounding shall be amended topsoil to follow general layout per landscape plan. Mounding is to be rounded at the top. Coordinate mounding with retaining wall construction. Final shaping and contouring of mounds to be approved by landscape architect. Provide drainage around mound away from building per civil grading plan intentions.

A. Subsoil removed from excavations may be used as planting soil. Plant pit backfill shall be amended per a soil analysis.

3.3 TREE, SHRUB, AND VINE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set stock plumb and in center of planting pit or trench with root flare flushwith adjacent finish grades.

1. Use native amended plant excavation soil in all areas for backfill.
2. Container-Grown: Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the

surrounding soil. Apply enough soil to cover the downhill side of the root ball, maintain with rock rip rap as required to maintain plant basin.

3.4 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

3.5 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.

B. Use amended and excavated planting soil in all landscape areas for backfill of plant pits.

C. Dig holes 3x larger than container to allow spreading of roots.

D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.6 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Compost Mulch in Plant Basins: Apply 2” for 5 gal. or less and 3” for greater than 5 gal. thickness of compost mulch over whole surface of individual plant watering basin area, and finish level with adjacent finish grade of mineral mulch. Do not place mulch within 4” of trunks or stems. Place after rock and or d.g. mulch is installed.
   2. Mineral Mulch: Provide a minimum of 4” minimum depth of rock or decomposed granite mulch per plan.

3.7 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.

D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION 32 93 00

SECTION 331100-WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. The Stonebrook 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 Washoe County.

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 Geotechnical Evaluation Silver Dollar Elementary School, dated June 10th 2024, prepared by Geotechnical & Environmental Services, Incorporated.

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 Geotechnical Evaluation Silver Dollar Elementary School, dated June 10th 2024, prepared by Geotechnical & Environmental Services, Incorporated.

D. SUMMARY

E. 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